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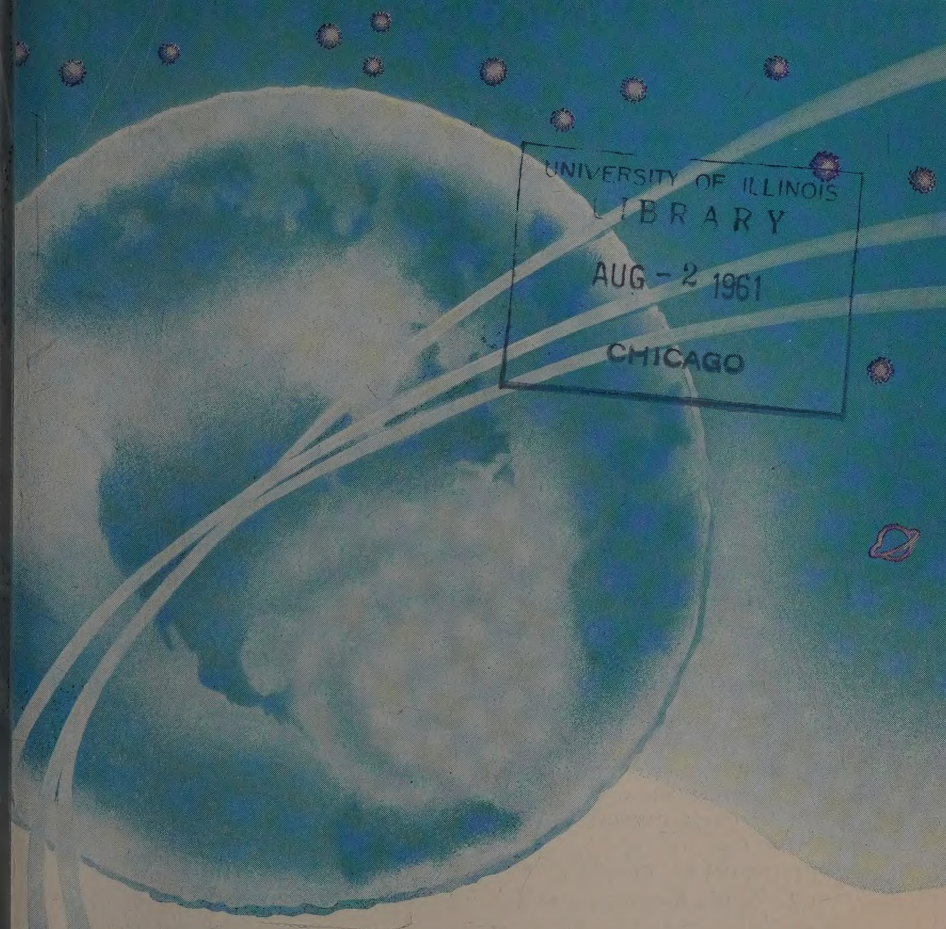

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Meteorological & Geoastrophysical ABSTRACTS

Vol. 11 DECEMBER 1960 No. 12
PART II

METEOROLOGICAL AND GEOASTROPHYSICAL ABSTRACTS

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METEOROLOGICAL AND GEOASTROPHYSICAL ABSTRACTS is a monthly publication devoted to:

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METEOROLOGICAL AND GEOASTROPHYSICAL ABSTRACTS

MALCOLM RIGBY, Editor

Vol. 11 December 1960 No. 12
PART II

Supported by

DEPARTMENT OF THE AIR FORCE
DEPARTMENT OF THE ARMY
DEPARTMENT OF THE NAVY
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
NATIONAL SCIENCE FOUNDATION
UNITED STATES WEATHER BUREAU

(*For table of contents see back cover*)

Published monthly at Prince and Lemon Streets, Lancaster, Pa., by the AMERICAN METEOROLOGICAL SOCIETY, 45 Beacon Street, Boston 8, Mass.

Printed and issued by: Lancaster Press, Inc.

INTRODUCTION

During 1950–1959 (Vol. I–X), *Meteorological Abstracts and Bibliography* consisted of 11 monthly issues (Jan.–Nov.), each with Current Abstracts, a Special Bibliography, Contents of Current Journals, and Author, Subject and Geographic Indexes. The December issue (No. 12) of each year comprised the Cumulative Annual Indexes.

In this volume (Vol. XI) a substantial number of abstracts of literature on the Upper Atmosphere, Space Exploration, Astrophysics of the Solar System, etc., have been included. So many pertinent abstracts in these fields have accumulated during the year, in excess of what could be published in the normal 11 issues, that it was decided that the backlog should be published as a regular December issue under the new title: *Meteorological and Geoastrophysical Abstracts*. In fact, in order to publish the 1000 items accumulated, it was necessary to publish the issue in two parts, the first with 600 abstracts (11.12–1 to 600) and this one with 400 (11L–1 to 400), each with the usual author, subject and geographical indexes. A detailed outline of the contents will be found on the back cover.

The usual Cumulative Annual Indexes will appear subsequently as volume indexes, but without identification by month or number as heretofore.

The work of compiling, editing, arranging, cross-referencing, and indexing of these two parts to the December 1960 issue has been performed by Geza Thuronyi with assistance from other members of the editorial staff of Meteorological and Geoastrophysical Abstracts. It is hoped that this material will be more valuable collected and arranged in one issue than it would be scattered through numerous future issues.

The preparation and publication of this issue has been made possible through support extended by the National Aeronautics and Space Administration (NASA).

Malcolm Rigby, Editor

FOREWORD

Meteorological and Geoastrophysical Abstracts is a monthly publication devoted to current literature in meteorology, geophysics and astrophysics.

Part I contains abstracts of current literature in the fields of meteorology, etc.

Part II of each issue comprises an annotated bibliography of important references on a special subject. Bibliographies published in the successive issues were:

Vol. I, 1950

1. Atmos. Pollution 2. Aerobiology 3. Cloud Physics 4. Hail
5. Tornadoes 6. Volcanic Dust 7. Climat. Changes 8. Thunderstorms
9. Icing 10. Acoust. Propagation 11. Evaporation

Vol. II, 1951

1. Extended Forecast. 2. Long Range Forecast. 3. Soil Temp. 4. Constants, etc.
5. Clim. of Near East 6. Clim. of Middle East 7. Special Winds 8. Radar Storm
9. Condensation Trails 10. Clim. of N. E. Africa 11. Mountain Met. Detect.

Vol. III, 1952

1. Clim. of N. W. Africa 2. Carbon Dioxide 3. Clim. of Argentina, etc. 4. Dew
5. Objective Forecast. 6. Stratus Forecast. 7. Urban Climatology 8. Clim. of C. Africa
9. Visibility 10. Glaze and Rime 11. Free Air Turbulence

Vol. IV, 1953

1. Turbulence Theory 2. Turbulent Diffusion 3. Frost 4. Clim. of Australia, etc.
5. High Level Winds 6. Winds in Stratosphere 7. Jet Stream 8. Radiation Bioclim.
9. Clim. of Pacific 10. Auroras 11. Sferics

Vol. V. 1954

1. Oceanog. Met. 2. Clim. of S. E. Asia 3. Auroral Physics 4. Tropopause
5. Balloons 6. Numerical Forecast. 7. Radiation Data 8. Vertical Motion
9. Clim. of Arctic 10. Industrial Met. 11. Wind Waves and Swell

Vol. VI, 1955

1. Bibliog. of Bibliog. 2. Texts & Monogr. Bibliogs. 3. Storm Surges
4. Ionospheric Prop. 5. Photochem.—Upper Atmos. 6. Cloud Physics
7. Radar Cloud Physics 8–9. Atmos. Nuclei 10. Weather Modification 11. Cooling Power

Vol. VII, 1956

1. Synoptic Met.-Arctic 2. Clim. of Enclosed Spaces 3. Cosmic Rays (–1952)
4. Cosmic Rays (1953–56) 5. Atmos. Radioactivity 6. Inversions
7. Snow Micromet. 8. Snow Micromet. (Suppl.) 9–11. Tropical Cyclones

Vol. VIII, 1957

1. Solar Weather Relations 2. Night Airglow 3. Forecasting Special Elements
4. Forest Micrometeorology 5. Hydromet. Forecasting 6. Numerical Forecast. (Suppl.)
7. Albedo 8. Meteors 9–10. Tropospheric Prop. 11. Medical Meteorology

Vol. IX, 1958

1. Radioastronomy 2. Solar Astrophysics 3. Radioactivity in Atmosphere
4. Waves and Currents 5. Physical Oceanog. 6. Dynamic & Phys. Oceanog.
7. Long Range Forecast. 8. Radar Met. 9. Cosmic Rays 10–11. Geomagnetism

Vol. X, 1959

1. Works of C. E. P. Brooks 2. Tornado Forecasting 3. Soil Moisture 4. Sferics
5–6. Ozone 7. Acoustic Waves 8. Evaporation Measurement
9. Evapotranspiration (–1955) 10. Evapotranspiration (1956–1959) 11. Evaporation

Vol. XI, 1960

1. Outstanding Reference Works 2. Outstanding Texts 3. Numerical Forecast. (Suppl.)
4. Ionospheric Physics 5. Ionospheric Propagation 6. Ionosphere
7. Forecast Verification 8. Radar Meteorology 9. Rocket Meteorology
10. Satellite Meteorology 11. Airglow

Bibliographies in preparation or published in Vol. XII

Aurora (No. 1) *Limnology* (No. 3) *Physics of Lightning*
Auroral Physics (No. 2) *Upper Atmosphere Structure* (No. 4, 5 and 6) *Precipitation Chemistry*

Part III contains a listing of reviews, translations, reprints, and the contents of important publications. These are published in the earliest issue where space permits.

Part IV is made up of author, subject and geographical indexes.

EXPLANATIONS

Location of material: For each entry, a symbol is given for at least one library where t material may be found. The Union List of Serials (Gregory) is the source of most of t symbols used. In some cases, where no symbol has been assigned to a library, one will devised according to the principles of the Union List.

Library symbols used frequently may be found in the following list:

DA:	U. S. Dept. of Agriculture Library, Washington, D. C.
DBS:	U. S. Bureau of Standards Library, Washington, D. C.
DGS:	U. S. Geological Survey Library, Washington, D. C.
DLC:	Library of Congress, Washington, D. C.
DN-HO:	U. S. Navy Hydrographic Office Library, Suitland, Md.
DNLM:	U. S. National Library of Medicine, Washington, D. C.
DSI:	Smithsonian Institution, Washington, D. C.
DWB:	U. S. Weather Bureau Library, Washington, D. C.

Other symbols:

*	before an entry indicates a good data source.
†	before an entry indicates a good bibliography.
§	before an entry indicates a synoptic case history study accompanied by char
Ⓢ	after an abstract indicates an abstract prepared for NASA.

Geographic locations are in the English form rather than the form used locally, for examp Moscow for Moskva.

Titles of articles or monographs are in the language of the original article unless otherwi stated. Slavic (Cyrillic) titles are transliterated into the Roman alphabet using a modific tion of the Library of Congress transliteration scheme.

Abbreviations:

Titles of periodicals are not abbreviated, as a rule.

The months of the year from March to July are not abbreviated. Other months a abbreviated as Jan., Feb., Aug., Sept., Oct., Nov., and Dec.

The word or abbreviation for Volume (Tom, Band, Jahrgang, Año, etc.), for Numb (Heft, Fascicule, Vypusk, etc.) and for page or pages is omitted from most entries. Thus entry will read as follows:

Meteorologische Rundschau, 2(5/6):146–151, May/June 1950.

This indicates that the article appeared in *Meteorologische Rundschau*, *Jahrgang* 2 (V 2), *Heft* 5/6 (No. 5/6), *pages* 146–151, May/June 1950.

PART II. COLLECTION OF CURRENT LITERATURE ON ASTRONOMY AND ASTROPHYSICS

GENERAL PROBLEMS

11L–1 550.3:523:061.3(794)

Astronomical Society of the Pacific, **Abstracts of papers presented at the San Francisco meeting . ., June 17–18, 1959.** *Astronomical Society of the Pacific, San Francisco, Publications*, 71(422): 381–393, Oct. **1959.** figs., 2 refs. **DLC**—Abstracts of 13 papers. Following are the titles of the papers: 1) Radar studies of the cislunar medium, 2) Recent tests with image tubes, 3) Orbits for planetary satellites from Doppler data alone, 4) The orbit of the spectroscopic binary θ^2 tauri, 5) Satellite studies of outer atmospheric ionization, 6) Electric power for lunar stations, 7) An image-tube experiment at the Lick Observatory, 8) Sensitive detectors for radio astronomy, 9) Galactic orbits of stars, 10) The orbit and spectrum of HO 95635, 11) Whistlers in the extraterrestrial environment, 12) Magnetic compression in the geomagnetic field as measured by Pioneer I, 13) Spectroscopic investigations of multiple galaxies and clusters of galaxies. *Subject Headings:* **1. Astronomical conferences 2. Geomagnetic studies 3. San Francisco, Calif.**—*I.S.* Ⓢ

11L–2 52:06

Morgan, W. W. (*Univ. of Chicago*), **Some vistas of astronomical discovery.** *Science*, Wash., D. C., 132(3419):73–75, July 8, **1960.** fig. Also in *Astronomical Society of the Pacific, San Francisco, Publications*, 72(426):153–158, June **1960. DLC**—This is an address delivered on March 15, 1959, at Kitt Peak, Ariz., on the occasion of the dedication of the Kitt Peak National Observatory. The text is written in popular style. The progress made in the field of optical astronomy during the past 30 yrs is traced and some characteristics of present research are reported. This survey shows that a major feature of 20th century astronomy has been the development toward a concept of continuities. At the end the possibilities of future development are explored. Those areas where breakthroughs in method have occurred recently are especially examined. *Subject Headings:* **1. Progress in astronomy 2. Astronomical sites 3. Kitt Peak National Observatory, Ariz.**—*I.S.* Ⓢ

11L–3 523.11:523.164

†Sciama, D. W. (*Univ. of London*), **Observational aspects of cosmology.** (In: Beer, Arthur (*ed.*), **Vistas in Astronomy,** Vol. 3, pub. **1960.** p. 311–328. fig., 97 refs., 6 eqs.) **DWB** (520.82 B415v), **DLC** (QB3.B35)—The article surveys the present observational status of cosmology. Despite several recent attempts, it is still not possible to decide whether the Universe is in a steady state or whether it has evolved from a much denser configuration. It is pointed out that radio astronomy will play an important role in cosmology, since radio sources can be detected at distances beyond the reach of the 200-inch telescope. *Subject Headings:* **1. Cosmology 2. Radio astronomy.**—*Author's abstract.* Ⓢ

11L–4 551.5:52

Schindler, Gerhard, **Astronomische Tatsachen in meteorologischer Sicht.** [Astronomical facts from a meteorological point of view.] *Naturwissenschaftliche Rundschau*, Stuttgart, 13(5):182–185, May **1960. DWB, DLC**—An attempt is made to answer some astronomical questions often addressed to meteorologists. They include: long period variations in the earth's orbital elements, such as eccentricity, perihelion and aphelion; the duration of the seasons; precession; the changes and the reform of the calendar; obliquity of the ecliptic; displacement of the poles; the date line; time equations; arc of the sun at various places; eclipses; motion of the moon; and the moon and variable church holidays. *Subject Heading:* **1. Popular astronomy.**—*O.T.* Ⓢ

11L–5 52:06 523.892

Gondolatsch, Friedrich (*Heidelberg*), **Astronomische Jahrbücher und Ephemeridenzeit.** [Astronomical yearbooks and ephemeride time.] *Naturwissenschaftliche Rundschau*, Stuttgart, 13(1): 1–14, Jan. **1960. DWB, DLC**—Observations in recent decades of oscillations of the speed of the rotation of the earth led to the introduction of ephemeride time into the astronomical yearbooks of 1960 for the first time. The explanation of ephemeride time is based on three different types of variations in the rotation time of the earth: 1) a steady deceleration, 2) irregular positive and negative

fluctuations in acceleration and 3) seasonal oscillations. The last mentioned due to meteorologi factors, is observed by quartz- and atomic-clock time comparisons. The definition of one second 1/31,556,925,9747 of the tropical year for 1900 January 0, 12 hour ephemeride time, as determin by the International Committee for Weights and Measures in 1956, and the conversion of measu ments of observed mean sun time into ephemeride time are explained. Moon observations may satisfactorily substituted for sun observations. Conversion is not possible in advance due to t irregular fluctuations of the speed of rotation. The importance of the use of atomic clocks in t last ten years is emphasized and their function is described. *Subject Headings:* **1. Ephemeride ti 2. Chronometry 3. Atomic clocks.**—*O.T.* Ⓢ

11L–6 523.12 523.51 523.8

†Cameron, A. G. W., **The origin of the elements.** *Physics and Chemistry of the Earth*, Vol. pub. N. Y., Pergamon Press, **1959.** p. 199–223. 7 figs., 40 refs., eqs. **DWB** (551.P578), **DL** (QC501.P53)—The author approaches the problem differentiating between the abundance of no volatile and volatile elements. Best sources of information for the first group are chemical and ra mechanical analyses of meteorites; for the latter group spectroscopic analyses of the light comi from stars and gaseous nebulae. A cosmic abundance distribution of the elements is present (Suess and Urey, 1956). The continuous interchange of material between the stars and the int stellar medium is a strong argument for nucleosynthesis in stellar interiors. The types of nucle reactions which can take place in stellar interiors are discussed and it is suggested that these reactio explain the cosmic abundance distribution of the elements. *Subject Headings:* **1. Cosmic distributi of elements 2. Cosmogony.**—*E.K.* Ⓢ

11L–7 531.51 :538.69 :537.

Alzofon, Frederick E. (*Lockheed Missiles and Space Div., Palo Alto, Calif.*), **The origin of t gravitational field.** *Advances in the Astronautical Sciences*, New York, Vol. 5, 1959, issued 196 p. 309–319. 15 refs., 34 eqs. **DWB** (629.1388 A512pro), **DLC** (QB1.A26)—This paper seeks explain the gravitational field as an averaged fluctuating electromagnetic field generated by t creation and annihilation of charged particles on a subatomic scale. One may consider such identification, for although a given mass may be electrically neutral on a macroscopic scale, it w not be so on a subatomic scale. Creation and annihilation processes are incorporated into physi theory in a fundamental manner by altering the concept of a light signal to include these proces as fluctuations. Because the space-time metric is quadratic, a root-mean-square effect is generat which allows description of matter and radiation by a single field. The equations of motion of t field are postulated and their solutions shown to reduce to a Coulomb-type field, in the mean. T force field generated by creation-annihilation processes is shown to be attractive, proportional to t mass of the source, and inversely proportional to the square of the separation of source and test bo The red shift observed in the light received from distant galaxies can be explained in terms of t proposed model in terms of particle creation, rather than as a Doppler shift. The Blackett formu relating the magnetic moment and angular momentum of a rotating astronomical body may derived under conditions defining its limitations. *Subject Heading:* **1. Gravity theories.**—*Autho abstract.* Ⓢ

11L–8 523.8 :523.

Mestel, L. (*St. John's College, Cambridge*), **Star formation and the galactic magnetic field.** (I Beer, Arthur (*ed.*), **Vistas in Astronomy,** Vol. 3, **1960.** p. 296–310. fig., 5 refs., 52 eqs.) **DW** (520.82 B415v), **DLC** (QB3.B35)—A strong galactic magnetic field, as postulated in much curre astronomical theory, must play an important role in the condensation of interstellar matter. In t article the author considers the effect of introducing a magnetic field into three problems that ha been much discussed in the literature: the condition of gravitational binding; the rate of accreti by a condensation already formed; and the evolution of a rotating disk. In all three cases the resu are significantly altered by the presence of the field. *Subject Headings:* **1. Galactic magnetis 2. Interstellar matter 3. Stellar evolution.**—*Author's abstract.* Ⓢ

11L–9 523.07 :576.

Huang, Su-Shu (*Berkeley Astron. Dept., Univ. of Calif.*), **The problem of life in the univer and the mode of star formation.** *Astronomical Society of the Pacific, San Francisco, Publicatio* 71(422) :421–424, Oct. **1959.** table, 7 refs. **DLC**—Several factors bearing on the problem of l in the universe are considered. First the time-scales of biological and stellar evolution are compare then, the size of the habitable zone around a star is considered. Next the formation of planeta systems around stars is studied and the method of detecting them is discussed. From these co siderations it is concluded that nearly all single stars of the main sequence below F_5 and perha above K_5 have a fair chance of supporting life on their planets. *Subject Headings:* **1. Stellar evoluti 2. Astrobiology.**—*I.S.* Ⓢ

11L–10 523.07:576.15

Vale, W. H., **Existence of life in the universe.** *Astronomical Society of Victoria, Journal*, 13(3):39–43, June **1960.** 4 refs. **DLC**—The possibilities of the existence of life in the universe are discussed in the light of our present knowledge relating to the formation of the solar system. It is concluded that the likely places where life of a high order outside the Solar System may exist are the main sequence F, G and K stars. However, it is unlikely, that well evolved life exists on any planet in the solar neighborhood. *Subject Headings:* **1. Astrobiology 2. Life in universe.**—*I.S.* Ⓢ

11L–11 521.114

Hénon, M. (*Institut d'Astrophysique, Paris*), **Les perturbations des vitesses stellaires.** [Perturbations of stellar velocities.] *Annales d'Astrophysique*, Paris, 23(3):467–473, May/June **1960.** 2 figs., 2 refs., 14 eqs. French, English and Russian summaries p. 467. **DWB, DLC**—Under certain conditions, the probability is calculated for a given velocity perturbation of a test star in motion in a field of stars. The general formula for the moments of order greater than 2 is derived. *Subject Headings:* **1. Stellar velocities 2. Velocity perturbation.**—*Author's abstract.* Ⓢ

11L–12 532.5

Porfir'ev, V. V. (*L'vov State Univ.*), **The law of rotation of a polytropic gas sphere.** *Soviet Astronomy AJ*, New York, 3(3):531–532, Dec. **1959.** 2 refs., 13 eqs. **DLC.** Transl. of **O zakone vrashcheniia politropnogo gazovogo shara,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(3):546–547, May/June **1959. DLC**—It is shown that a rotating polytropic gas sphere, in the absence of internal friction and circulating currents, can be in equilibrium only if the rotation is rigid. *Subject Heading:* **1. Rotation of gas spheres.**—*Author's abstract.* Ⓢ

11L–13 538.69:532.59

Green, H. S. (*Dublin Inst. for Adv. Studies*), **Ionic theory of plasmas and magnetohydrodynamics.** *Physics of Fluids*, N. Y., 2(4):341–349, July/Aug. **1959.** 11 foot-refs., 54 eqs. **DWB**—This paper aims at removing certain sources of confusion in plasma theory by deriving a complete set of macroscopic equations based on the ionic theory. Relativistic and quantum effects are usually neglected, and an approximation equivalent to that of the macroscopic theory of irreversible processes is adopted. But there is no other approximation, and in particular multiple interactions are fully accounted for. The theory of the dielectric constant and permeability of plasmas is sketched, and there follows an ionic derivation of the equations of continuity, and of energy and momentum transport, based on an exact separation of the long-range and short-range forces. It is shown how the short-range forces contribute to the pressure, the energy flux, and the flux of entropy. The ionic basis of the theory of irreversible processes is discussed, and its relevance to the generalization of Ohm's law. In an appendix, the formal statistical thermodynamics of plasmas is developed in a way which avoids certain difficulties associated with the long-range interactions. *Subject Headings:* **1. Magneto-hydrodynamic theories 2. Plasma theory 3. Ionic theory of plasmas.**—*Author's abstract.* Ⓢ

11L–14 538.69:532.59

Gershman, B. N. (*Gor'kiĭ State Univ.*), **On the problem of the propagation of magnetohydrodynamic waves in cosmic conditions.** *Soviet Astronomy AJ*, New York, 3(1):193–195, Jan./Feb. **1959.** 8 refs., 4 eqs. **DLC.** Transl. of **K voprosu o rasprostranenii magnitogidrodinamicheskikh voln v kosmicheskikh usloviiakh,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(1):190–191, Jan./Feb. **1959. DLC**—Results which follow from the kinetic theory of magnetohydrodynamic waves in a plasma are applied to some cases in astrophysics (waves inside the sun, in its atmosphere and in the interstellar medium). It is found that the specific attenuation of waves in the plasma is not connected with collisions as it exceeds the attenuation due to this factor. *Subject Heading:* **1. Magneto-hydrodynamic waves in plasma.**—*Author's abstract.* Ⓢ

11L–15 537.56 538.69:532.59

†Lehnert, B. (*Royal Inst. of Technology, Stockholm*), **Plasma physics on cosmical and laboratory scale.** *Nuovo Cimento*, Bologna, Supplement No. 1 to Ser. 10, Vol. 13, **1959.** p. 59–110. 4 figs., 6 tables, 70 refs., 134 eqs. **DLC**—The behavior of an ionized gas under cosmic and laboratory conditions is examined. The increased dissipation of magneto-hydrodynamic waves is proved to be in agreement with conclusions of PIDDINGTON and COWLING. Experimental illustrations show agreement with the collision diffusion theory and they support the drain diffusion mechanism suggested by BOHM, BURHOP, MASSEY and WILLIAMS. The determination of the electron temperature, the arrangement of the experimental apparatus and some results of the experiment are discussed. *Subject Headings:* **1. Ionized media 2. Magneto-hydrodynamic waves in plasma 3. Magnetic influences 4. Plasma physics.**—*O.T.* Ⓢ

11L–16 523.877

Schatzman, E. (*Inst. d'Astrophysique, Paris*), **Le plasma stellaire.** [Stellar plasma.] *Nuovo Cimento*, Bologna, Supplement No. 1 to Ser. 10, Vol. 13, **1959.** p. 166–188. 8 figs. **DLC**—The properties of plasma are analyzed theoretically for different values of temperature and density, using different approximations. Thermodynamic equilibrium is assumed, which implies a velocity distribution according to Maxwell's law and a distribution of populations of energy levels according to Boltzmann's law. Particular problems treated are: degenerate electron clouds; influence of the shielding effect upon thermonuclear reaction rates; thermonuclear reactions; and influence of electron clouds upon thermonuclear reactions, including spontaneous fission. *Subject Headings:* **1. Stellar plasma 2. Plasma physics.**—*O.T.* Ⓢ

11L–17 523.74/5 523.877

Biermann, L. (*Max Planck-Inst. für Physik und Astrophysik, Munich*), **Stellar atmospheres as a plasma.** *Nuovo Cimento*, Bologna, Supplement No. 1 to Ser. 10, Vol. 13, **1959.** p. 189–204. 11 refs., 15 eqs. **DLC**—The equations of motion, Ohm's law and Maxwell's equations with numerical examples are considered in general. The solar atmosphere, sunspots, the heating mechanism of the chromosphere and the corona and, finally, the state of ionization of the solar corona are examined as problems of plasma physics in the solar atmosphere. Hydromagnetic problems of interplanetary space are analyzed, including: isorotation, force-free fields, and the transport of angular momentum; densities, velocities, and magnetic fields in interplanetary space and comet tails. *Subject Headings:* **1. Stellar atmospheres 2. Plasma physics.**—*O.T.* Ⓢ

11L–18 523.03:551.594.12

Rozis-Saulgeot, Anne-Marie, **Sur les régions très ionisées de la matière interstellaire.** [Highly ionized regions of interstellar matter.] *Académie des Sciences, Paris, Comptes Rendus*, 248(5):650–653, Feb. 2, **1959.** **DWB, DLC**—The author draws a parallel between the properties of the highly ionized regions of the interstellar substance and the superconductivity of metals at low temperatures. This analogy leads to a fairly new description of certain regions of the interstellar substance. *Subject Headings:* **1. Interstellar matter 2. Ionized interstellar regions 3. Conductivity of metals.**—*A.V.* Ⓢ

11L–19 535.43:533.1

Kaplan, S. A.; Klimishin, I. A. and Sivers, V. N. (*all, L'vov Astronomical Observatory*), **Scattering of light in a medium with a moving boundary.** *Soviet Astronomy AJ*, New York, 4(1):7–12, July/Aug. **1960.** 5 refs., 24 eqs. **DLC.** Transl. of **Teoriia rasseianiia sveta v srede s dvizhushcheĭsia granitseĭ**, *Astronomicheskiĭ Zhurnal*, Moscow, 37(1):9–15, Jan./Feb. **1960. DLC**—In order to study the interaction between gas motion and radiation by the methods of the modern theory of light scattering, it is necessary to solve the problem of light scattering in a medium with a moving boundary. The calculation of the probability of escape of a quantum from the medium after scattering is reduced to the solution of integral equations for cases when the quantum is in an absorbed state most of the time, or if it is in a free state most of the time. The theory of light scattering as applied to the study of the interaction between gas motion and radiation will be given in future papers. *Subject Headings:* **1. Scattering of light 2. Gas dynamics.**—*Authors' abstract.* Ⓢ

11L–20 534:535.34

Kaplan, S. A. and Klimishin, I. A., **Nekotorye zamechaniia ob izluchenii sveta udarnymi volnami v kosmicheskikh usloviiakh.** [Some notes on the emission of light by shock waves under cosmic conditions.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(2):281–283, March/April **1960.** 6 refs., 11 eqs. Russian and English summaries p. 281. **DLC.** Transl. into English in *Soviet Astronomy AJ*, New York, 4(2):264–266, **1960. DLC**—A study is made of the heating of gas in front of a shock wave, using the theory of light scattering in a medium with a moving boundary. Formulas are given which may be used to calculate the temperature distribution in the heated zone, and the width of this zone. Equations are developed to describe the increase in the intensity of radiation before the wave reaches the surface, which is due to the penetration of radiation through the higher-lying layers. *Subject Headings:* **1. Shock waves 2. Light emission by shock waves.**—*Authors' abstract.* Ⓢ

11L–21 534

Skripkin, V. A., **Reliativistskiw popravki v zadache o tochechnom vzryve v ideal'noĭ gravitiruiushcheĭ sploshnoĭ srede.** [Relativistic corrections in the problem of a point explosion in an ideal gravitating continuous medium.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(2):284–296, March/April **1960.** fig., 8 refs., numerous eqs. Russian and English summaries p. 284. **DLC.** Transl. into English in *Soviet Astronomy AJ*, New York, 4(2):267–278, **1960. DLC**—An attempt is reported (1) to apply the small-parameter expansion method (in the present case, the small parameter is the reciprocal of the square of the velocity of light) to the equations of motion of a continuous medium in which shock waves are being formed, using the general theory of relativity; (2) to separate out the

Newtonian hydrodynamic theory as a zero-order approximation; (3) to elucidate the details of the connection between equations describing the successive approximations; and (4) to compare first-order corrections with the zero-order values. In order to obtain a comprehensive result, the discussion is limited to a centrally symmetric field, and the zero-order approximation is taken to be in the form of SEDOV'S simple, but exact, solution for a point explosion in an ideal medium gravitating according to Newton's law, the specific heat ratio being $\gamma = 4/3$. Under the approximations employed, the state of matter and radiation in the universe as a whole corresponds approximately to this value of γ. It is shown that a gravitational wave is propagated in the undisturbed medium in front of the shock wave. *Subject Headings:* **1. Shock waves 2. Explosion waves 3. Point explosions.**—*Author's abstract.* Ⓢ

11L–22 523.161:546.33

Kaplan, S. A. and Kurt, V. G., **Razlet natrievogo oblaka v mezhplanetnom prostranstve.** [On the expansion of a sodium cloud in interstellar space.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(3): 536–542, May/June **1960.** 2 figs., table, 4 refs., 19 eqs. Russian and English summaries p. 536. Translated into English in *Soviet Astronomy AJ*, New York, 4(3):508–514, Nov./Dec. **1960. DLC**—The problem of the expansion of gas in vacuum is studied experimentally (from observations of a sodium cloud) and theoretically. It is shown that the expansion can be divided into two stages: adiabatic expansion and free expansion. During the first stage the temperature falls by 350–600 degrees, during the second stage the atoms maintain their thermal velocities. Formulas were obtained for connecting the velocity of adiabatic expansion a and the thermal velocity of the second stage c_k, for the density distribution, and for surface brightness. The reduction of observational data showed good agreement with theory and permitted the determination of the velocities $a = 1.40$ kc/sec and $c_k = 0.87$ km/sec. The results are only very slightly sensitive to the selected model of initial distribution. At this stage the case of spherical expansion is in somewhat better agreement with observations. The assumption that the adiabatic stage is totally absent is in sharp contradiction with observational data. *Subject Headings:* **1. Artificial sodium clouds 2. Diffusion of gases in interplanetary space.**—*Authors' abstract.* Ⓢ

OBSERVATORIES, INSTRUMENT CARRIERS

See also: **Radio observatories of the world** (Mumford), 11L–76; **Radio Astronomy Centre, Univ. of Sydney** (Messel), 11L–77; **Solar radio astronomy at Fort Davis** (Thompson), 11L–84; **Meanook-Newbrook meteor observatories** (Millman), 11L–142; **Eclipse chasing above the clouds** (Kennedy), 11L–311.

11L–23 522.1(47) 523.7(47)

Douglas, A. Vibert (*Queen's Univ., Kingston, Ont.*), **Astronomers visit four USSR observatories.** *Royal Astronomical Society of Canada, Journal*, 53(2):74–77, April **1959. DLC**—This is a report on a visit to four U.S.S.R. observatories; the Astrophysical Observatory of the Crimea, the Semeis Observatory, the Abastumani Observatory in the southern Caucasus and the Burakan Astrophysical Observatory. Descriptions of facilities and mention of the staff met at each observatory are given. *Subject Headings:* **1. Astrophysical observatories 2. Astronomical observatories 3. U.S.S.R.** —*E.Z.S.* Ⓢ

11L–24 522.1(68)

Evans, David S. (*Royal Observatory, Cape Town*), **Some aspects of South Africa astronomy.** *Annales d'Astrophysique*, Paris, 23(3):436–438, May/June **1960.** French, English and Russian summaries p. 436. **DWB, DLC**—Description of observatories now in operation in South Africa: The Cape, Johannesburg, Leiden Southern Observatory, Boyden Station and Radcliffe Observatory. Observing programs of these stations. *Subject Headings:* **1. Astronomical observatories 2. South Africa.**—*Author's abstract.* Ⓢ

11L–25 523.743 551.507.321.2:551.571.7

Dollfus, A., **Observations astronomiques en ballon libre, I–III.** [Astronomical observations by free balloon, Pt. 1–3.] *L'Astronomie*, Paris, 73(9):345–362, Sept. **1959**; 73(10/11):411–426, Oct./Nov. **1959**; 73(12):467–487, Dec. **1959.** 17 figs., 12 refs. **DLC**—This article sets forth the principle and advantages of astronomical observations by free balloon. A short historical account recalls the first astronomical observations by balloon made at the end of the 19th century; the stability of a balloon as to the transport of astronomical instruments in the upper atmosphere is examined. The author describes thoroughly the aerostatic outfit and the astronomical device meant for the ascents. He gives an account of the 3 ascents made respectively on May 30, 1954, November 22, 1956 and

April 1, 1957. Preparation, launching, observations made and return of each of these ascents is described in detail. The second, and principally the third, ascent brought an important contribution in the study of the photospheric granulation, the distribution of the granular structure, the contrast of granules, etc. Besides the astronomical observations, noteworthy are the data relating to the water content of the atmosphere at high altitudes. During the first ascent, the vapor content of the whole of the atmosphere above 6500 m corresponded to a 0.25 mm sheet of water. At the surface during the days preceding this ascent, the total amount of water vapor contained in the atmosphere corresponded to a layer of water ranging from 15 mm–30 mm according to the circumstances. The last part of the article concerns ascents whose aerostatical device was composed of a group of 30 or 100 sounding balloons. A detailed description is given of the construction of the cabin, which requires special conditioning for the physiological safety of the observer-pilot. These ascents enabled observations on winds at high altitudes, on the decrease of atmospheric scattering in the neighborhood of the tropopause, and on the radioactivity in the stratosphere which was 220 times as strong as that observed at the surface level. *Subject Headings:* **1. Balloon clusters 2. Astronomical observations by balloons 3. Upper air observations 4. Photosphere 5. Upper air humidity 6. Radioactivity in the stratosphere.**—*A.V.* Ⓢ

11L–26 551.507.362.1:535.853:523.75

Friedman, Herbert (*U. S. Naval Res. Lab., Wash., D. C.*), **Rocket astronomy.** *Journal of Geophysical Research*, Wash., D. C., 64(11):1751–1763, Nov. **1959.** 13 figs. **DLC**—In rocket astronomy it is enough to get to 300 km which is well above almost all the absorbing atmosphere. The improvement of spectrographs, especially which will be insensitive to wave length above the Lyman-α wave length, but highly sensitive to shorter ones, will have great application in future work. One of the purposes of the rocket astronomy program of the IGY was to get information on the X-ray and ultraviolet emission spectrum of a solar flare. It was found, that a flare produces bright X-ray flash. Spectrographs have been used with great success by TOUSEY and his associates at NRL, by REMSE at the Univ. of Colorado and by HINTEREGGER at the Air Force Cambridge Res. Center. A description is given of the measurements and results obtained of X-ray distribution during a solar eclipse on Oct. 12, 1958. The author further points to the fact, that rocket astronomy has provided the first picture of the ultraviolet night sky. The ultraviolet nebulosities were found superimposed on a bright diffuse glow of Lyman-α that covers the entire sky. *Subject Headings:* **1. Rocket astronomy 2. IGY rocket program 3. Solar spectrum.**—*E.K.* Ⓢ

11L–27 551.507.362:535.853:523.75

Friedman, Herbert (*U. S. Naval Research Lab., Wash., D. C.*), **Recent experiments from rockets and satellites.** *Astronomical Journal*, New Haven, Conn., 65(5):264–271, June **1960.** 9 figs., table, 15 refs. **DLC**—During 1959, rocket experiments succeeded in advancing several areas of ultraviolet and x-ray astronomy. The solar disk was photographed in Lyman-α with a resolution of better than one minute of arc. Spectrograms were obtained down to wavelengths below the He I and He II resonance lines. Solar x-ray emission coincident with visible flares was mapped from 60 A down to 0.2 A. For the first time a small optical telescope was used for the study of ultraviolet emissions in the night sky. It demonstrated the feasibility of ultraviolet color mapping of the stars and has given us some new clues to the nature of the ultraviolet nebulosities surrounding the early stars. *Subject Heading:* **1. Rocket astronomy 2. Solar spectrum.**—*Author's abstract.* Ⓢ

11L–28 551.507.362:523.87

Code, Arthur D. (*Univ. of Wisc.*), **Stellar astronomy from a space vehicle.** *Astronomical Journal*, New Haven, Conn., 65(5):278–284, June **1960.** 7 figs. **DLC**—Space research in stellar astronomy will initially concentrate on observations in the vacuum ultraviolet and X-ray region. Future observations will be substantially aided by a series of general sky surveys in the ultraviolet both by rocket flights and satellite observations. This paper describes some of the stellar observations that might prove most profitable in the light of current astrophysical knowledge. The topics discussed fall under the following headings: A. Ultraviolet and infrared survey studies, B. Stellar energy distribution, C. Stellar spectroscopy, D. Interstellar medium, E. Extragalactic studies, and F. High resolution studies. *Subject Headings:* **1. Rocket astronomy 2. Satellite uses in astronomy 3. Progress in astronomy.**—*Author's abstract.* Ⓢ

11L–29 551.507.362.2:522.2

Meinel, A. B. (*Kitt Peak National Obs., Tucson, Ariz.*), **Astronomical observations from space vehicles.** *Astronomical Society of the Pacific, San Francisco, Publications*, 71(422):369–380, Oct. **1959. DLC**—An interesting discussion of the scope and possibilities of astronomical observations from space vehicles. The requirements that a space telescope must meet and the design problems are discussed. The discussion is divided into two parts. The first part consists of astrophysical considerations. Eight general areas of fruitful research and discovery in space astronomy are

enumerated. In the second section ten principal problem areas relative to engineering considerations for a space telescope are considered. *Subject Headings:* **1. Satellite uses in astronomy 2. Rocket astronomy 3. Telescopes on satellites.**—*I.S.* Ⓢ

11L–30 551.507.362:523.87

Whipple, Fred L. and Davis, Robert J. (*both, Smithsonian Astrophysical Obs., Cambridge, Mass.*), **Proposed stellar and interstellar survey.** *Astronomical Journal*, New Haven, Conn., 65(5):285–290, June **1960.** 6 figs., 15 refs. **DLC**—Previous planning for the design, construction and operation of an astronomical telescope in a satellite orbit was presented by members of the Smithsonian Astrophysical and Harvard College Observatories (R. J. Davis, R. E. McCrosky, F. L. Whipple, and C. A. Whitney, *Astron. J.* 64, 50, **1959**). Further elaboration of these plans is presented, including possible systems for measuring bright-line radiation of the interstellar medium and obtaining slitless spectra of stars, as well as a broad survey of the entire sky in three colors between 1000 and 3000 A. With the support of the National Aeronautics and Space Administration the design program is under way at the Smithsonian Astrophysical Observatory. Plans are also developing for an Aerobee rocket firing in late 1960 or early 1961 in which a TV image-tube system covered by a multicolor mosaic filter can produce a preliminary shallow survey of both nebulosity and bright stars over a strip of the sky some 150° by 4°. Since the rocket will be neither precisely stabilized nor controlled at high altitudes, the exact position of the observational strip can only be approximated. Direct image photographs of stars and nebulosity, however, will be available in spectral regions from below Lyman-alpha to approximately 2000 A. The Westinghouse Electric Corporation has undertaken the development of special materials for TV image tubes sensitive to spectral regions in the far UV. The precise spectral regions in which the rocket and satellite experiments will be conducted depend upon these developments. The astrophysical significance is discussed of the proposed experiments in the regions of Lyman-alpha and above for stars and interstellar material. *Subject Headings:* **1. Rocket astronomy 2. Satellite uses in astronomy.**—*Authors' abstract.* Ⓢ

11L–31 551.507.362.2:535.33:523.162

Spitzer, Lyman, Jr. and Zabriskie, Franklin R. (*both, Princeton Univ. Obs.*), **Interstellar research with a spectroscopic satellite.** *Astronomical Society of the Pacific, San Francisco, Publications*, 71(422):412–420, Oct. **1959.** 2 tables, 11 refs. **DLC**—The interstellar absorption lines of sodium and calcium in the visible spectra of the hotter stars permit only a very introductory survey of the interstellar gas. But measures of interstellar lines in the far ultraviolet would be possible. This paper points out the lines one might hope to observe and discusses the specific programs that might be carried out with an ultraviolet spectroscopic telescope on a satellite. It is indicated that any satellite using conventional ultraviolet spectroscopic equipment must be prepared to confine the spectral range investigated to longwards of 912 A. *Subject Headings:* **1. Satellite uses in astronomy 2. Stellar spectroscopy.**—*I.S.* Ⓢ

INSTRUMENTS, METHODS OF OBSERVATION AND COMPUTATION

See also: **Observational aspects of cosmology** (Sciama), 11L–3; **Radio astronomy apparatus,** 11L–81 to 11L–85; **Planetary orbit chart** (Callaghan), 11L–138; **Photographic observation of Sun's photosphere** (Rösch), 11L–219; **Indirect detection of solar flares** (Del Vecchio), 11L–261; **Spectroscopy of solar flares, French IGY program** (Michard et al.), 11L–267; **Flash spectrum by grazing incidence method during eclipse** (Suemoto, Hiei), 11L–314; **Extragalactic spectroscopy** (Minkowski), 11L–372; **Determination of abundances and its experimental requirements** (Pecker), 11L–389.

11L–32 522.2

Couder, André (*Observatoire de Paris*), **Le grand télescope du C.N.R.S. Description générale.** [The big telescope of the National Scientific Research Center. General description.] *Annales d'Astrophysique*, Paris, 23(3):311–319, May/June **1960.** 2 figs., 9 refs. French, English and Russian summaries p. 311. **DWB, DLC**—Description of the 193-cm telescope which the C.N.R.S. has installed at the Observatory of Haute-Provence: general layout, mounting, building and dome and the air flow system. *Subject Headings:* **1. Telescopes 2. Haute-Provence Observatory, France.** —*Author's abstract.* Ⓢ

11L–33 535.242:535.83

Argue, A. N. (*The Observatories, Cambridge, Eng.*), **Experiences in photometry with the Cambridge Schmidt telescope.** (In: Beer, Arthur (*ed.*), **Vistas in Astronomy,** Vol. 3, pub. **1960.** p. 184–

202. 11 figs., 3 tables, 11 refs., 2 eqs.) **DWB** (520.82 B415v), **DLC** (QB3.B35)—The purpose of this paper is to describe a preliminary investigation of the performance of the Cambridge Schmidt telescope in photometry, and to relate it to the general subject of photographic photometry. Emphasis is placed on the dependence on measuring procedure, particularly towards the photographic threshold. The results suggest that the field errors are low within a diameter of at least three degrees, and that magnitude transfers can be performed, provided that the exposures are of a few minutes' duration only. Mention is made of the use of the EDSAC electronic computer, for reducing the large number of measurements. *Subject Headings:* **1. Photometry 2. Telephotometers 3. Telescopes 4. Electronic data processing.**—*Author's abstract.* Ⓢ

11L–34 522.2:537.531

Baez, Albert V. (*Smithsonian Astrophysical Obs., Mass.*), **A proposed X-ray telescope for the 1- to 100-A region.** *Journal of Geophysical Research*, Wash., D. C., 65(9):3019–3020, Sept. **1960.** 2 figs., 5 refs. **DLC**—Image-forming devices to focus on solar and other X-ray sources in space, suggested by the 1960 pinhole radiograph of the Sun made by FRIEDMAN, are proposed and explained. Achromatic image-forming devices faster than the zone plate are needed to be able to operate in the shorter wave length region from about 1 to 100 A. A crude prototype of the first telescope is described. Illustrations show the images of a small hole illuminated by 2537-A radiation made by the multiple-crossed-mirror system, and the image of an extended object. The second telescope, a contemplated improvement of the first is to be made with spherical mirrors, with no practical loss in resolution. The useful range of multiple-crossed-mirror systems is likely to be 1 to 100 A or beyond. *Subject Heading:* **1. X-ray telescopes.**—*O.T.* Ⓢ

11L–35 535.417

Astronomy in Australia: stellar interferometer of the School of Physics, University of Sydney. *Nature*, London, 186(4721):270–271, April 23, **1960.** **DWB**—An intensity interferometer, the first and only instrument of its kind conceived and designed by R. Q. TWISS and R. HANBURY BROWN is to be completed towards the end of 1960 and assembled at Narrabri, New South Wales early in 1961. The parts are briefly described and artists sketch shows the assemblage. It should be possible to measure about 140 of the brightest stars, but use is limited to observations on the hotter stars. *Subject Heading:* **1. Interferometers.**—*E.Z.S.* Ⓢ

11L–36 535.33.072

Keberle, Edouard (*Bern*), **Distribution de l'intensité le long d'une raie du spectrographe magnétique à 180°.** [Intensity distribution along a ray in the 180° magnetic spectrograph.] *France. Centre National de la Recherche Scientifique, Journal des Recherches*, 10(46/49):283–288, Dec. **1959.** 7 figs., 2 tables, 5 refs., eqs. **DLC**—It is shown that one can determine point by point the form of a given ray with an 180° magnetic focusing spectrograph with the aid of a simple geometric construction utilizing a model in the form of an ellipse. It is noted that in the case where the source and the slit are of the same order of magnitude, the intensity of the ray is given by the superposition of partial rays corresponding with the different intervals at the source. Appendices show the derivation of the equations. *Subject Heading:* **1. Spectrographs.**—*E.Z.S.* Ⓢ

11L–37 522.617.3

Bridge, H. S.; Dilworth, C.; Rossi, B. et al. (*all, Physics Dept. Lab. of Nuclear Scien. M. I. T.*), **An instrument for the investigation of interplanetary plasma.** *Journal of Geophysical Research*, Wash., D. C., 65(10):3053–3055, Oct. **1960.** fig., ref. **DLC**—The instrument is designed to determine the density, direction, and magnitude of the bulk velocity of the protons of the interplanetary plasma. It is essentially a Faraday cup containing four grids which serve (a) to keep the electrons of the plasma from reaching the collector, and (b) to suppress the photoelectric current by modulating the incoming protons without modulating the photoelectrons produced when the cup faces the sun. A transistorized electronic system amplifies, compresses, and demodulates the a-c signal from the collector before transmitting it to the telemetry system of the vehicle. Current densities from 10^{-12} to 10^{-8} amp/cm^2, and proton kinetic energies from 10 to 3000 ev, can be measured. *Subject Heading:* **1. Interplanetary plasma probes. I. Scherb, F. II. Lyon, E. F.**—*Authors' abstract.* Ⓢ

11L–38 523.85:778.3

Keene, George T., **Some suggestions on astrophotography.** *Sky and Telescope*, N. Y., 18(3):134–137, Jan. **1959.** figs. (including photos), table, eq. **DWB, DLC**—Success in obtaining good photographs of nebulae, clusters, and galaxies is shown by the seven photographs. The author has tabulated a list of equipment, object to be photographed, film and developer, and exposure time recommended for successful astrophotography. *Subject Heading:* **1. Astrophotography.**—*E.Z.S.* Ⓢ

11L–39 523:771.3:539.1.07

Lallemand, A.; Duchesne, M.; Wlérick, G. et al. (*all, Observatoire de Paris-Meudon*), **Les possibilités actuelles de la photographie électronique.** [The present possibilities of electronic photography.] *Annales d'Astrophysique*, Paris, 23(3):320–330, May/June **1960.** 10 figs., 8 refs., 5 plates. French, English and Russian summaries p. 320. **DWB, DLC**—The results achieved up-to-now by the electronic camera indicate a gain in sensitivity of 1000 to 10,000 in comparison with ordinary photography, if the plate is reduced by counting the trails of the photoelectrons. Microphotometric measurements give further gains of 50 to 100. Contrast and definition of the images are also definitely improved. *Subject Headings:* **1. Astrophotography 2. Electronic photography. I. Augarde, R. II. Dupré, M. F.**—*Authors' abstract.* Ⓢ

11L–40 523:771.3:539.1.07

Fehrenbach, Charles (*Observatoires de Marseille et de Haute-Provence*), **Quelques recherches à développer grâce à la photographie électronique.** [Some researches which might be developed by the use of electronic photography.] *Annales d'Astrophysique*, Paris, 23(3):335–343, May/June **1960.** 3 figs. French, English and Russian summaries p. 335. **DWB, DLC**—The author recalls the possibilities of the electronic camera in sensitivity and contrast, especially when it is associated with various spectrographs. He proposes to use it to study type II stellar populations, interstellar calcium lines, line profiles and, above all, rotation and expansion of galaxies. *Subject Headings:* **1. Astrophotography 2. Electronic photography 3. Galactic rotation.**—*Author's abstract.* Ⓢ

11L–41 523.855:771.3:539.1.07

Mayall, N. U. (*Lick Observatory, Calif. Univ.*), **Advantages of electronic photography for extragalactic spectroscopy.** *Annales d'Astrophysique*, Paris, 23(3):344–359, May/June **1960.** 4 figs., 19 refs., 11 plates. French, English and Russian summaries p. 344. **DWB, DLC**—Among the problems which require more advanced observational techniques and which electronic photography could help to solve, the author cites the measurements of radial velocities in the Coma cluster of galaxies, the internal motions and rotations in the galaxies, spectral characteristics of supergiant galaxies and particularly the broadening of their lines, the existence of HeI and the possible selective absorption of emission lines. *Subject Headings:* **1. Astrophotography 2. Electronic photography 3. Stellar spectroscopy 4. Galactic structures.**—*Author's abstract.* Ⓢ

11L–42 523.854.3:771.3:539.1.07

Lindblad, B. (*Stockholm Obs.*), **The importance of methods of electronic photography for certain problems concerning the structure and dynamics of galaxies.** *Annales d'Astrophysique*, Paris, 23(3):373–374, May/June **1960.** French, English and Russian summaries p. 373. **DWB, DLC**—The increase in the contrast of the plates should improve our knowledge of the spiral arms of some galaxies such as N.G.C. 4594 and of the halo of the peculiar galaxy N.G.C. 7331. It should help us to study the internal motions of barred spirals and to verify the theories concerning this subject. *Subject Headings:* **1. Galactic structures 2. Astrophotography 3. Electronic photography.**—*Author's abstract.* Ⓢ

11L–43 523.84.035.921.2

Rozhkovskiĭ, D. A. and Gaĭnullina, R. Kh., **Ob iskazhenii krivoĭ bleska, naĭdennoĭ po fotografiiam s dlitel'noĭ vyderzhkoĭ.** [Deformation of the brightness curve obtained by long-exposure photographs.] *Akademiia Nauk Kazakhskoĭ SSR. Astrofizicheskiĭ Institut, Izvestiia*, 8:19–23, **1959.** 3 figs., 2 tables, 5 refs., eq. English summary p. 23. **DLC**—The distortion of the brightness curve of a variable star, derived from photographic observations with long exposure, is considered. By comparing a true curve with a distortion, an equation is obtained which can be used in the construction of the true brightness curve at least in the first approximation. *Subject Headings:* **1. Stellar brightness 2. Astrophotography.**—*Authors' abstract.* Ⓢ

11L–44 535.24

Kron, Gerald E. (*Univ. of Calif.*), **Multiple colour photometry.** (In: Beer, Arthur (*ed.*), **Vistas in Astronomy,** Vol. 3, pub. **1960.** p. 171–183. 4 figs., 27 refs.) **DWB** (520.82 B415v), **DLC** (QB3.B35)—Multiple photometry is discussed historically. Modern photometric systems are discussed and bibliographies are given. Demonstrations of some of the properties and uses of multiple color photometry are given, with emphasis placed on the infrared spectral region. The determination of color temperatures by means of multiple color photometry is discussed. *Subject Heading:* **1. Multiple color photometry.**—*Author's abstract.* Ⓢ

11L–45 523.852.3:535.243

Seaton, M. J. (*Dept. of Physics, Univ. College, London*), **Problems of Nebular photometry.** *Annales d'Astrophysique*, Paris, 23(3):360–365, May/June **1960.** fig., 4 tables, 6 refs. French,

English and Russian summaries p. 360. **DWB, DLC**—The author suggests some spectrophotometric measurements which would be of special theoretical interest. *Subject Headings:* **1. Spectrophotometric observations 2. Nebular emission lines.**—*Author's abstract.* Ⓢ

11L–46 535.243:523.7/8

Parriiskii, N. N. and Gindilis, L. M. (*both, P. K. Shternberg St. Astron. Inst.*), **New luminophores of constant brightness for spectrophotometry of faint objects. Energy distribution in the spectrum of the luminophores.** *Soviet Astronomy AJ*, New York, 3(3):524–528, Dec. **1959.** table, 15 refs., 3 eqs. **DLC.** Transl. of **Novye liuminofory postoiannogo deistviia dlia spektrofotometrii slabykh ob"ektov. Raspredelenie energii v spektre liuminoforov,** *Astronomicheskii Zhurnal*, Moscow, 36(3):539–543, May/June **1959. DLC**—The luminophores of constant brightness with β-active activators which give a continuous spectrum in a broad band of wavelengths, that have been developed at the Luminescence Laboratory of the P. N. Lebedev Physical Institute of the U.S.S.R. Academy of Sciences, will undoubtedly find wide application in problems dealing with the absolute spectrophotometry of faint celestial objects. Results are presented from a study of the energy distribution in the spectrum of the first samples of such luminophores, activated by the artificial isotope Sr^{90}, with a half-life of 20 years. The visual brightness of the luminophores is 0.015 apostilb. The energy distribution in absolute units was investigated in the wavelength interval 4400 to 6400 A by comparison with the energy distribution in the spectrum of α Lyr and reference to the Sun through the stellar magnitudes of α Lyr and the Sun. The results are given in ergs and quanta per cm^2 per steradian per second for the interval $\Delta\lambda = 1$ cm. The brightness is of the order of 600 quanta per cm^2 per second for a solid angle of 1 square degree, and an interval $\Delta\lambda = 1$ A. *Subject Headings:* **1. Spectrophotometry of faint objects 2. Luminance sources 3. Stellar radiation.**—*Authors' abstract.* Ⓢ

11L–47 523.8:551.521.9

†Willstrop, R. V. (*The Observatories, Cambridge*), **Absolute measures of stellar radiation.** *Royal Astronomical Society, London, Monthly Notices*, 121(1):17–40, **1960.** 9 figs., 4 tables, 25 refs., eqs. **DWB, DLC**—Observations at the Cambridge Observatories showed that the broad-band V and B photometric systems may be reproduced by observations in narrow bands about 200 A broad centered at 5410 A and at 4390 A, respectively. At the Royal Observatory, Cape of Good Hope, measurements were made of the radiation flux outside the Earth's atmosphere in four narrow (~200 A) wave length bands from stars of known magnitude and colour index, by comparing bright stars with an artificial star, composed of a calibrated lamp and blue filter. A 4-inch refractor was used, with interference filters and a d.c. photometer. The results are given in Table I. They are in good agreement with some other recent measurements. Systematic errors are discussed in detail. Narrow-band visual magnitudes were measured for 221 stars, and compared with broad-band visual magnitudes determined by JOHNSON, by HOGG and by EGGEN, and with early and recent Cape results. When linear color equations are removed the standard deviations of the residuals are between $\pm 0^m.014$ and $\pm 0^m.036$. The internal random errors of the best individual series are believed to be $\pm 0^m.010$ (narrow-band) $\pm 0^m.007$ (JOHNSON) and $\pm 0^m.007$ (Cape). It follows that the large differences usually found between similar broad-band visual magnitudes cannot be explained by differences of band-width and equivalent wave length combined with differences of stellar spectra. There is good agreement between the present narrow-band color indices and gradients on the Greenwich system measured at Mt. Stromlo. The relation between absolute and Greenwich gradients was found to be $\phi = G_a - 1.11$, in excellent agreement with the best previous results. *Subject Heading:* **1. Stellar radiation.**—*Author's abstract.* Ⓢ

11L–48 535.243:523.821.2

†Martinov, D. Ia. (*P. K Shternberg St. Astron. Inst.*), **The visual stellar magnitude of the sun, the moon, and the lux.** *Soviet Astronomy AJ*, New York, 3(4):633–644, Jan./Feb. **1960.** 3 tables, 34 refs., 4 eqs. **DLC.** Transl. of **Vidimaia zvezdnaia velichina Solntsa, Luny i liuksa,** *Astronomicheskii Zhurnal*, Moscow, 36(4):648–661, July/Aug. **1959. DLC**—The values of the integral stellar magnitudes of the sun $m_\odot$, moon m_M and international lux (1948) m_0, adopted at present, have been reexamined, this being possible as a result of the very precise photoelectric and spectrophotometric studies made after 1948. Such a reexamination is necessary because of the great uncertainty of the international photovisual system (IP_v) adopted up to the present time. The values have been obtained on three photometric systems: 1) visual, based on Zinner's catalog, 2) quasi IPv, based on a reduction formula which connects IPv with PD, and 3) V, in the system U, B, V.

(1)	(2)	(3)	
$m_\odot = -26^m.59$	$-26^m.76$	$-26^m.80$	(± 0.03)
$m_M = -12.54$	-12.68	-12.71	(± 0.06)
$m_0 = -13.75$	—	-13.78	(± 0.03)

In the HR system: $m_{\odot} = -26.73$, $m_0 = -13.89$. *Subject Headings:* **1. Sun's stellar magnitude 2. Moon's stellar magnitude 3. Lux stellar magnitude.**—*Author's abstract.* Ⓢ

11L–49 535.242 523.813:522.2:539.1.07

Bouigue, Roger (*Obs. de Toulouse*), **Sur la mesure photoélectrique des distances galactiques et extra-galactiques.** [The photoelectric measurement of galactic and extragalactic distances.] *Annales d'Astrophysique*, Paris, 23(3):444–450, May/June **1960.** 2 figs., 9 refs. French, English and Russian summaries p. 444. **DWB, DLC**—The author discusses the method of measuring galactic and extragalactic distances by photoelectric observations. A new method is proposed that gives a better determination of intrinsic photometric properties of supergiants. An improvement of fundamental constants, using the electronic camera, is suggested. Another program of observations of elliptic galaxies by the electric telescope is proposed. It should permit the maximum exploitation of the results of the photoelectric measurements. *Subject Headings:* **1. Photoelectric observation techniques 2. Astronomical distances 3. Electronic telescopes.**—*Author's abstract.* Ⓢ

11L–50 535.243:523.877

Mel'nikov, O. A.; Kuprevich, N. F. and Zhukova, L. N. (*all, Acad. Sci., U.S.S.R.*), **Absolute spectrophotometric gradients for stars derived by reference to a "star" with a high color temperature.** *Soviet Astronomy AJ*, New York, 3(4):575–577, Jan./Feb. **1960.** 3 figs., table, 4 refs. **DLC.** Transl. of **Absoliutnye spektrofotometricheskie gradienty zvezd, poluchennye priviazkoĭ k "zvezde" s vysokoĭ tsvetovoĭ temperaturoĭ,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(4):585 588, July/Aug. **1959. DLC**—The absolute gradients of five stars of early subclasses of A spectral type: ϵ UMa, β UMa, α CrB, θ Leo and γ Gem, were determined by the method of reference to a "star" with an infinite gradient (spectrophotometric color) temperature, elaborated at the Pulkovo Observatory (A. Zh., 33, 845, 1956). The observations were made with the help of a new photoelectric device with recordings on a bifilar oscillograph. The agreement between consecutive recordings and the gradients determined from them is satisfactory. The mean gradient of early subclasses of A-type stars, $\bar{\Phi} = 1.01$, which for the mean investigated region of the spectrum 0.41. corresponds to $Tg(A) = 16{,}000°K$, this value being in accordance with previous results. *Subject Headings:* **1. Stellar spectra 2. Spectrophotometry.**—*Authors' abstract.* Ⓢ

11L–51 535.24:550.380.87:523.74

Kotliar, L. M., **Novaia skhema differentsial'nogo fotometra dlia solnechnogo magnitografa.** [A new design of a differential photometer for a solar magnetograph.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(3):469–475, May/June **1960.** 3 figs., 7 refs., 30 eqs. Russian and English summaries p. 469. Transl. into English in *Soviet Astronomy AJ*, New York, 4(3):445–450, Nov./Dec. **1960. DLC**—A new design of a differential photometer for a solar magnetograph is described. It differs from the existing types in that one photomultiplier is used instead of two and that there is auxiliary modulation of the light beam by means of an electro-optical crystallic modulator. Analytical expressions describing the process of transformation of the light beam in the instrument are given. *Subject Headings:* **1. Photometers 2. Solar magnetographs.**—*Author's abstract.* Ⓢ

11L–52 681.1.4:621.38:52

Wrubel, Marshal H. (*Indiana Univ., Bloomington*), **The electronic computer as an astronomical instrument.** (In: Beer, Arthur (*ed.*), **Vistas in Astronomy,** Vol. 3, pub. **1960.** p. 107–116. 5 figs., 4 refs., eqs.) **DWB** (520.82 B415v), **DLC** (QB3.B35)—The enormous potential of the electronic computer as an instrument of observational and theoretical research is emphasized. Astronomical examples are used to illustrate the concept of programming and the flexibility of electronic computers. Specific recommendations are made for the effective use of these devices in astronomy. *Subject Heading:* **1. Electronic computer applications in astronomy.**—*Author's abstract.* Ⓢ

11L–53 681.177:519.2:535.33

Phillips, John G. (*Berkeley Astronomical Dept., Calif. Univ.*), **The application of digital computers to the reduction and analysis of high-dispersion molecular spectra.** *Astrophysical Journal*, Chicago, 130(1):308–323, July **1959.** 5 figs., 5 tables, 8 refs., 6 eqs. **DWB, DLC**—Programs have been developed for the IBM 701 digital computer for the calculation of vacuum wave numbers from line measurements and for the identification of the branches into which the lines of individual bands may be divided. Tests on representative spectra show that great savings of time and labor may be achieved, especially if the programs are used in conjunction with digitizing equipment on the measuring machines to punch the measurements directly onto IBM cards. *Subject Headings:* **1. Electronic data processing 2. Spectrum analyzers.**—*Author's abstract.* Ⓢ

11L–54 521.1

Clemence, G. M., (*U. S. Naval Obs., Wash., D. C.*), **Controlled experiments in celestial mechanics.** *Astronomical Journal*, New Haven, Conn., 65(5):272–273, June **1960. DLC**—Experi-

ments are described for measuring a possible dependence of the earth's gravitational field on its orbital velocity, a secular change in the constant of gravitation, the constants of the orbit of the earth, the mass of the moon, and the mechanical ellipticity of the moon. *Subject Heading:* **1. Celestial mechanics.**—*Author's abstract.* Ⓢ

11L–55 551.521:535.211

Sitnik, G. F. (*P. K. Shternberg State Astronomical Inst.*), **General principles for the realization of a model of a black body at a high temperature.** *Soviet Astronomy AJ*, New York, 4(1):74–82, July/Aug. **1960.** fig., 13 refs., 13 eqs. **DLC.** Transl. of **Obshchie printsipy osushchestvleniia modeli chernogo tela pri vysokoĭ temperature,** *Astronomicheskiĭ Zhurnal*, Moscow, 37(1):75–85, Jan./Feb. **1960. DLC**—A discussion is given of the general principles for the realization of a model of a black body, to be used as a primary standard in the calibration of spectrophotometric measurements in absolute energy units. The various factors which influence the degree of correspondence between the practical model and the perfect black body are discussed. The effect of a nonuniform temperature distribution on the accuracy of the model is considered again. A theoretical treatment has led to a rational scheme for constructing a model of a black body whose radiation is identical with the thermal-equilibrium radiation at the given temperature. *Subject Headings:* **1. Black body standards 2. Spectrophotometry.**—*Author's abstract.* Ⓢ

11L–56 537.12

Gutman, A. M. and Levinson, I. B. (*both, Vilnius State Univ., Inst. of Physics and Math., Academy of Sciences, Lithuanian SSR*), **Nonhomogeneous vector coupling in atomic spectra.** *Soviet Astronomy AJ*, New York, 4(1):83–84, July/Aug. **1960.** 2 tables, 3 refs. **DLC.** Transl. of **Neodnorodnye vektornye sviazi v atomnykh spektrakh,** *Astronomicheskiĭ Zhurnal*, Moscow, 37(1):86–87, Jan./Feb. **1960. DLC**—Possible forms of vector coupling in configurations with a strongly excited electron are considered. It is pointed out that it is necessary to take into account nonhomogeneous coupling in the classification of states. *Subject Heading:* **1. Excitation mechanisms.**—*Authors' abstract.* Ⓢ

11L–57 522.33:535.242

Efimov, A. A. and Otriashenkov, Iu. M. (*both, Main Astronomical Obs., Academy of Science, U.S.S.R.*), **Photoelectric method for recording circle readings of meridian instruments.** *Soviet Astronomy AJ*, New York, 4(1):140–144, July/Aug. **1960.** 5 figs., 2 refs. **DLC.** Transl. of **Fotoelektricheskiĭ metod otscheta krugov meridiannykh instrumentov,** *Astronomicheskiĭ Zhurnal*, Moscow, 37(1):146–150, Jan./Feb. **1960. DLC**—A photoelectric technique for recording circle readings has been developed, and an experimental working model has been built. Tests of the arrangement have shown that this method can be used for automatic recording of limb readings to a precision of 0.1μ in linear units. Errors in the readings are largely independent of the quality of the calibration marks, which may be dark against a light background, or vice-versa. *Subject Heading:* **1. Meridian instruments.**—*Authors' abstract.* Ⓢ

11L–58 522.983.12

Pil'nik, G. P. (*P. K. Shternberg St. Astron. Inst.*), **Determination of the position of the [non] collimation line.** *Soviet Astronomy AJ*, New York, 3(5):849–856, March/April **1960.** 2 figs., 6 tables, 8 refs., 3 eqs. **DLC.** Transl. of **Opredelenie polozheniia beskollimatsionnoĭ linii,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(5):874–882, Sept./Oct. **1959. DLC**—It is usually assumed that during a night of observations the position of the noncollimation line in the body of the instrument does not change. It is shown in this paper that this assumption is incorrect. The law of variation of the position of this line as a function of the zenith distance is given for two transit instruments. An analysis of the errors in the determination of collimation and the clock correction leads to the conclusion that these errors are quite common. *Subject Headings:* **1. Collimation line 2. Astronomical measurement errors.**—*Author's abstract.* Ⓢ

11L–59 529.71

Sukharev, L. N., **Sovmestnoe opredelenie shiroty mesta i popravki chasov iz nabliudeniĭ chetyrekh zvezd na ravnykh vysotakh.** [A simultaneous determination of latitude and clock correction from observations of four stars at equal altitudes.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(3):555–566, May/June **1960.** 6 figs., 4 tables, 5 refs., 18 eqs. Russian and English summaries p. 555. Transl. into English in *Soviet Astronomy AJ*, New York, 4(3):528–538, Nov./Dec. **1960. DLC**—GAUSS' idea on the simultaneous determination of the latitude and clock correction from observations of stars at equal altitudes is developed. It is proved that for this purpose it is best to observe four stars. Formulas for the selection of the corresponding stars are deduced and their nomographic solution given. It is noted that the methods of ZINGER and PEVTSOV are particular

cases of the proposed method. *Subject Headings:* **1. Chronometry 2. Latitude measurement.**—*Author's abstract.* Ⓢ

11L–60 529.7 551.501.8:621.396.8

Sopelnikov, M. D. and Baulin, I. V. (*both, Kharkov State Inst. of Measures and Measuring Instruments*), **Spark chronoscope for the oscillographic reception of time signals.** *Soviet Astronomy AJ*, New York, 4(1):145–149, July/Aug. **1960.** 6 figs., 2 refs. **DLC.** Transl. of **Iskrovoĭ khronoskop dlia ostsillograficheskogo priema signalov vremeni,** *Astronomicheskiĭ Zhurnal*, Moscow, 37(1): 151 155, Jan./Feb. **1960. DLC**—It is noted that the oscillographic method of reception of time signals, in which it is possible to estimate the form of the received signal visually, considerably increases the precision of reception, even in the presence of industrial and atmospheric noise. A description is given of a device which may be used to receive and record phased time signals which are required in this method. The device was designed at the Kharkov Institute for Measures and Measuring Instruments. The random error in the reception of the time signals by a longwave station is given. *Subject Headings:* **1. Chronometry 2. Time signals.**—*Authors' abstract.* Ⓢ

11L–61 529.7 537.725

Ishchenko, M. A.; Platonov, Iu. P. and Sukhov, V. B. (*all, Main Astronomical Obs., Academy of Sciences, U.S.S.R.*), **An oscillographic apparatus for the reception of time signals.** *Soviet Astronomy AJ*, New York, 4(1):150–153, July/Aug. **1960.** 3 figs., table. **DLC.** Transl. of **Ostsillograficheskaia ustanovka dlia priema signalov vremeni,** *Astronomicheskiĭ Zhurnal*, Moscow, 37(1):156–160, Jan./Feb. **1960. DLC**—A brief description is given of a device for the reception of second-pulses and rhythmic time signals, using an oscillograph with continuous circular scanning. The latter is convenient for reading off the position of the radio signal. The change in the rate of scanning in transferring from the reception of second-pulses to the reception of rhythmic signals is made with the aid of a gear reducer connecting the selsyn motor (which controls the uniform scanning) to the deflecting system. The error involved in the reception of time signals with the aid of this device can be reduced to 0.3–0.6 msec. *Subject Headings:* **1. Chronometry 2. Time signals.**—*Authors' abstract.* Ⓢ

11L–62 551.501 531.714:522.53 531.76

Guinot, B., **Comment on note l'instant précis d'un phénomène astronomique.** [How one notes the exact moment of an astronomical phenomenon.] *L'Astronomie*, Paris, 74(4):157–164, April **1960.** 4 figs. **DLC, NNC, DWB**—Time determination involves two functions: 1) observation of a phenomenon of which the ephemeris can be computed, for example, passing through the meridian; 2) taking notice of the clock hour at the very moment when this phenomenon occurs. This second point is the object of this article. The author first briefly exposes the old methods which left to the observer the double role of determining the passage and of noting the time. He then reports the most up-to-date methods which are purely automatic. The article is divided in two parts, the first dealing with spider-lines and micrometers (fixed cross-wires, method of pip switch-pear; impersonal mobile-wire micrometers, photographic recordings and photoelectric recordings). The second part is devoted to chronographs; one gives the principal characteristics and the working principle of tape unrolling chronographs, printing chronographs and totalizing chronographs. *Subject Headings:* **1. Chronometry 2. Chronographs.**—*A.V.* Ⓢ

11L–63 525.622

Longman, I. M. (*Inst. of Geophysics, Univ. of California*), **Formulas for computing the tidal accelerations due to the moon and the sun.** *Journal of Geophysical Research*, Wash., D. C., 64(12): 2351–2355, Dec. **1959.** fig., 8 refs., 34 eqs. **DLC**—A summary of formulas with which the tidal accelerations due to the moon and the sun can be computed at any given time for any point on the Earth's surface, without reference to tables, is presented in this paper. These formulas are convenient for computer use. *Subject Headings:* **1. Solar tides 2. Tidal computations.**—*Author's abstract.* Ⓢ

11L–64 538.74:522.9:527

Ezhov, N. N., **Choice of celestial body for compass error determinations in the case of dead reckoning errors.** *Soviet Astronomy AJ*, New York, 4(1):166–173, July/Aug. **1960.** fig., 4 refs., 15 eqs. **DLC.** Transl. of **Vybor svetila dlia opredeleniia popravki kompassa pri nalichii oshibok schisleniia puti korablia,** *Astronomicheskiĭ Zhurnal*, Moscow, 37(1):173–181, Jan./Feb. **1960. DLC**—This paper discusses the effect of dead-reckoning errors on the accuracy of calculations of the compass course to be made good by a ship (airplane, or any other locomotive object carrying a compass on board as course indicator), from point of departure to point of arrival, for which a formula is derived, giving the relation between the error in compass correction and the extent of the dead-reckoning error. It is shown that, in the presence of unavoidable errors in dead reckoning, the term "compass-

correction error," generally used in marine navigation for solving the problem of calculating compass course, does not correspond to reality, since this quantity is not an error in the sense indicated, but an indispensable quantity. The author reaches the conclusion that determination of compass correction as a course correction necessitates selecting some heavenly body whose zenith angle is equal to the length of the ship's track on this course; the required heavenly body must be found at the zenith of the point of arrival. This choice of heavenly body simplifies the task of determining the necessary course, reducing it to one of taking the compass bearing of the heavenly body. The choice of heavenly body is of no consequence when determining compass correction as a bearing correction, in sightings where three bearings are taken, since any quantity arrived at for the compass correction, including an erroneous one, will, in that case, be excluded from the results of the round of sightings, after the lines of position are plotted on the chart or on paper. A fix based on two lines of position requires choosing a low-altitude heavenly body. This article refutes the main conclusions arrived at by A. B. MARINBAKH. *Subject Headings:* **1. Compass correction 2. Navigational astronomy.**—*Author's abstract.* Ⓢ

ATMOSPHERIC AND OTHER EFFECTS ON MEASUREMENT ACCURACY

See also: **Amplitude and phase of radio star scintillation** (Goodman), 11L–85.

11L–65 535.242:523.162

Rozis-Saulgeot, Anne-Marie (*Institut d'Astrophysique de Paris*), **Du rôle des raies d'absorption dans la photométrie photoélectrique à grande bande passante.** [The role of absorption lines in large passing band photoelectric photometry.] *Annales d'Astrophysique*, Paris, 23(4):504–515, July/Aug. **1960.** 4 figs., 3 tables, 4 refs. French, English and Russian summaries p. 504. **DWB, DLC**—The purpose of this study is to show the role of absorption lines in the interpretation of large passing band photoelectric measurements. Their effects on the magnitudes, on the color indices and in the case of red stars, on the color excesses are discussed as well as their effects on the measurements of interstellar absorption. *Subject Heading:* **1. Photoelectric photometry.**—*Author's abstract.* Ⓢ

11L–66 535.51:523.038

Kaplan, S. A. and Klimishin, I. A. (*both, L'vov Astron. Observ.*), **On the correlation between the observed difference in the degree of interstellar polarization and the angular distance of the corresponding points on the celestial sphere.** *Soviet Astronomy AJ*, New York, 3(2):362, March/April **1959.** 2 refs. Transl. of **O korreliatsii nabliudaemoĭ raznosti stepeni mezhzvezdnoĭ poliarizatsii s uglovym rasstoianiem sootvetstvuiushchikh tochek na nebesnoĭ sfere,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(2):370, March/April **1959. DLC**—It is shown that there exists a correlation between the difference in the degree of polarization of a pair of stars and their angular distance on the celestial sphere. It is possible that this correlation may be explained by the turbulent nature of the interstellar magnetic field. *Subject Headings:* **1. Interstellar polarization 2. Interstellar magnetic fields.**—*Authors' abstract.* Ⓢ

11L–67 525.723 551.521.3:523.87:535.335

Matiagin, V. S., **Koeffitsienty prozrachnosti zemnoĭ atmosfery v ul'trafiolete, opredelennye po nekotorym zvezdam.** [Coefficients of transparency of the earth's atmosphere in the ultraviolet for some stars.] *Akademiia Nauk Kazakhskoĭ SSR. Astrofizicheskiĭ Institut, Izvestiia*, 8:53–58, **1959.** 2 figs., 6 tables, 6 refs., 5 eqs. English summary p. 58. **DLC**—Photographic observations of rising and setting stars in the ultraviolet region of the spectrum for the determination of the atmospheric transparency by Bouguer's method were made with a Fabry tube. In 1956–57 during 7 nights 21 coefficients of transparency for 8 stars were determined. The smoothed curves of the coefficients show some dependence on the spectral type of stars. For the star α *Lyr* of class Ao (active λ is 373 mμ) the value of the mean coefficient of transparency is 0.662. *Subject Headings:* **1. Transparency coefficient 2. Stellar spectra.**—*Author's abstract.* Ⓢ

11L–68 525.723 551.591.1

Kharitonov, A. V., **K voprosu ob opredelenii nochnogo koeffitsienta prozrachnosti.** [Determining the coefficient of transparence at night.] *Akademiia Nauk Kazakhskoĭ SSR. Astrofizicheskiĭ Institut, Izvestiia*, 9:53–55, **1959.** 2 eqs. English summary p. 55. **DLC**—A method is proposed for determining instantaneous values of coefficient of transparency according to BOUGUER's law and simultaneous observation of a star near the polar region. The method makes it possible to obtain the variation of transparency in the course of time. *Subject Heading:* **1. Transparency coefficient.**—*Author's abstract.* Ⓢ

11L–69 522.92

Omarov, S. Z. (*Acad. Sci., U.S.S.R.*). **The calculation of the combined effect of differential refraction and aberration.** *Soviet Astronomy AJ*, New York, 3(3):520–523, Dec. **1959.** 7 tables, 2 refs., 3 eqs. **DLC.** Transl. of **Vychislenie polnogo vliianiia differentsial'noĭ refraktsii i aberratsii,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(3):535–538, May/June **1959. DLC**—Some recommendations are given on the practical application of the equations derived by the author for calculating the combined effect of differential refraction and aberration. *Subject Headings:* **1. Astronomical refraction 2. Astronomical measurement errors.**—*Author's abstract.* Ⓢ

11L–70 551.593.55

Fesenkov, V. G. (*Acad. Scien. Kazakh SSR*), **On the optical state of the atmosphere illuminated by twilight.** *Soviet Astronomy AJ*, New York, 3(2):207–213, March/April **1959.** 5 tables, 2 refs., 5 eqs. **DLC.** Transl. of **Ob opticheskom rezhime atmosfery pri sumerechnom osveshchenii,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(2):201–207, March/April **1959. DLC**—A method is given for computing the trajectories of light rays traveling through the atmosphere at different heights above the earth's surface, as well as the refraction and extinction corresponding to them. The results of computations of that type are entered in numerical tables, and may prove useful in the theory of twilight phenomena, the photometric theory of lunar eclipses and similar problems. *Subject Headings:* **1. Atmospheric optics 2. Twilight phenomena.**—*Author's abstract.* Ⓢ

11L–71 522.4

Panaiotov, L. A., **O kompensatsii refraktsionnykh effektov pri pomoshchi vakuumnoĭ prizmy.** [The compensation of refraction effects by means of a vacuum prism.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(2):336–341, March/April **1960.** 2 figs., ref., 5 eqs. Russian and English summaries p. 336. Translation into English in *Soviet Astronomy AJ*, New York, 4(2):317–321, **1960. DLC**—The possibility of the use of a vacuum prism for astrometric purposes is considered. The expediency of this suggestion in the study of refraction under different conditions in astrometric practice is shown. The use of the vacuum prism in photographic astrometry will allow the compensation of differential refraction and atmospheric dispersion. A brief discussion is given of the main requirements imposed on the device, and the technological possibilities of their fulfillment. *Subject Headings:* **1. Astrometric instruments 2. Astronomical measurement errors.**—*Author's abstract.* Ⓢ

11L–72 551.521.3:551.510.3:551.510.53

Sugawa, Chikara (*Int. Latitude Obs. of Mizusawa*), **On the relation between the anomalous refraction and the local Z term.** *Astronomical Society of Japan, Tokyo, Publications*, 12(1):42–54, **1960.** 4 figs., 3 tables, 18 refs., 27 eqs. **DLC**—The effect of the anomalous refraction due to the tilting of the air-strata of equal density in the upper atmosphere is studied by applying aerological observations with the radiosonde during the years 1950–54. The inclinations of the air-strata of equal density appear to reverse their signs at the height of about 8 9 km. The effect of the anomalous refraction shows a distinct seasonal variation which is similar to that of the wind effect in the lower atmosphere. Accordingly, the wind effect has been found to be a very convenient indicator of the anomalous refraction in the upper atmosphere. In the annual component of the local Z term, the effect of the anomalous refraction seems to be combined with error of the adopted micrometer value. The author tried to infer the latter from the seasonal variation of the wind effect as a first approximation. The six-monthly and four-monthly components of the local Z term are almost free from error of the micrometer value and are mainly caused by the room refraction. *Subject Headings:* **1. Refraction anomalies 2. Astronomical refraction.**—*Author's abstract.* Ⓢ

11L–73 551.593.12:523.8 525.722

Elsässer, H. and Siedentopf, H., **Zur Theorie der astronomischen Szintillation. I.** [Theory of astronomical scintillation, Pt. 1.] *Zeitschrift für Astrophysik*, Berlin, 48(3):213–230, **1959.** 4 figs., 2 tables, 17 refs., 38 eqs. **Pt. 2.** *Ibid.*, 50(4):278–295, **1960.** 6 figs., 10 refs., 24 eqs. English summaries. **DLC**—In Pt. I the passage of visible starlight through the Earth's turbulent atmosphere is studied by means of geometrical and wave optics. In contrast to earlier investigations the scintillation phenomena are treated as resulting from the influence of the whole atmosphere. This is made possible by the assumption of a model atmosphere which consists of many turbulent layers one upon another. In Pt. 2 the changes in brightness and direction (seeing) of the light from stars near the zenith are discussed on the basis of a geometrical theory. By comparison of the brightness scintillation at sea level with that observed at an altitude of 3600 m on the Jungfraujoch an exponential decrease of the fluctuations in the index of refraction n with increasing height in the atmosphere is derived. The calculated rms fluctuation σn at sea-level lies between $0.3 \cdot 10^{-8}$ and $1.3 \cdot 10^{-8}$, the equivalent fluctuation in temperature follows as $0.°03 < \sigma(T) < 0.°13$. The main contribution to the changes in brightness comes from atmospheric layers near 8 km above sea-level, whereas the contributions to the changes in the direction of the incident light decrease exponentially with increasing

height. In Pt. 2 a diffraction theory of stellar scintillation is presented, including a discussion of t conditions for the validity of the geometrical approximation and considerations of the variation scintillation with increasing zenith distance. *Subject Headings:* **1. Scintillation 2. Atmosphe turbulence.**—*Authors' abstract.* Ⓢ

11L–74 551.593.12:535.

Zhukova, L. N. (*Acad. Sci., U.S.S.R.*), **Chromatic scintillations.** *Soviet Astronomy AJ*, Ne York, 3(3):533–534, Dec. **1959.** 2 figs., 2 refs. **DLC.** Transl. of **O khromaticheskikh mertsaniiak** *Astronomicheskiĭ Zhurnal*, Moscow, 36(3):548–549, May/June **1959. DLC**—In order to study t chromatic scintillations of stars, their spectral trails were photographed. Photometric measur ments were made in the region λ5800–3800 A. It was found that for $z \geq 75°$, no correlation is o served between the variations of brightness in different spectral regions for Δλ200–1000 A. *Subj Headings:* **1. Scintillation 2. Photometric observation techniques.**—*Author's abstract.* Ⓢ

RADIO ASTRONOMY

GENERAL

11L–75 523.164:061.3(7

National Research Council. U. S. National Committee on the International Scientific Rad Union, **Report of U. S. Commission 5 on Radio Astronomy, to the 13th General Assembly of the ISR London, Sept. 5–15, 1960.** *U. S. National Bureau of Standards, Journal of Research, Sec. D*, 64(6 655–669, Nov./Dec. **1960.** Bibliog. p. 667–669. **"Review of developments occurring within th U. S. in the field of radio astronomy." DWB, DLC**—Highlights of developments and activiti (1957–1960) in radio astronomy in the U. S. are evaluated separately for each of the followi research centers: Univ. of Alabama; AFCRC, Sagamore Hill Radio Astronomy Observator U. S. Army Signal Research and Development Lab.; California Inst. of Tech., Owens Valley Radi Obs.; Carnegie Inst. of Washington, Dept. of Terr. Magnetism; Cornell Univ.; Collins Radio Co Univ. of Colorado High Altitude Obs.; Harvard Univ. Radio Astronomy Station; Hayden Plan tarium; Univ. of Illinois; U. S. Naval Res. Lab., Radio Astronomy Branch; National Aeronauti and Space Admin.; NBS Boulder Lab.; Natl. Radio Astronomy Obs.; Ohio State Univ.; Rensselae Polytech. Inst.; Stanford Univ.; Yale Univ. and Univ. of Michigan. The report is complemente by the current references to each of the several topics considered. *Subject Headings:* **1. Radi astronomy research 2. U. S. A.**—*W.N.* Ⓢ

11L–76 523.164:522.

Mumford, George S., III (*Tufts Univ.*), **Radio observatories of the world.** *Sky and Telescop* N. Y., 18(6):300–301, April **1959.** photos. **DWB, DLC**—The distribution of the radio observa tories of the world, based on J. L. Pawsey's IAU report is shown on maps and the stations in eac country briefly identified. Photographs of world's largest steerable radio telescope at Jodrell Ban Experiment Station and an artist's drawing of the 140-foot dish and mounting of the large radi telescope now under construction at the National Radio Astronomy Observatory, West Virginia a included. *Subject Heading:* **1. Radio astronomy observatories.**—*E.Z.S.* Ⓢ

11L–77 523.164:522.

Messel, H., **The new Radio-Astronomy Centre of the University of Sydney.** *Nature*, Londo 188(4750):528–529, Nov. 12, **1960.** fig. **DWB**—The new Centre has been established by th Chatterton Astronomy Department of the School of Physics and the School of Electrical Engineerin One group, led by B. Y. Mills, will engage immediately on radio astronomy work beginning wit detailed observations of sources of radio emission within the Galaxy and in distant regions. A ne radio telescope is to be built in the form of a cross with dimensions of about a mile. This will operat on two different wave lengths, near 75 cm and near 3 m. The arms of the cross will be in the for of cylindrical parabolas with "line" feeds for the two wave lengths at their foci. The output of dat from the instrument will be in the form of paper tape which can be fed directly to an electron computer. *Subject Headings:* **1. Radio astronomy observatories 2. Radio telescopes.**—*R.B.* Ⓢ

11L–78 523.16

†Oster, Ludwig, **Der kontinuierliche Absorptionskoeffizient für Frei-Frei-Strahlung im radi frequenten Spektralgebiet.** [The continuous absorption coefficient for free-free-emission in th radio frequency spectrum.] *Zeitschrift für Astrophysik*, Berlin, 47(3):169–190, **1959.** 4 figs table, 30 refs., 89 eqs. **DLC** (QB1 Z4)—The theory of free-free-emission in the radio frequenc

ange is critically investigated. The reasons for the differences in the numerical results which arise, hen the absorption coefficient is derived directly instead of the emission coefficient, and when use is ade of classical instead of quantum mechanical formulae, are explained. For practical use in strophysics and experimental work an expression is given covering the entire range of interest of emperature, density and frequency. *Subject Headings:* **1. Absorption of radio waves 2. Radio stronomy 3. Radio emission.**—*Author's abstract.* Ⓢ

11L–79 523.164:662.2:539.1:538.56:551.521.32

Johnson, Montgomery H. (*Aeronutronic Div., Ford Motor Co.*) and Lippmann, Bernard A. (*Lawrence Radiation Lab., Univ. of Calif., Livermore*), **Electromagnetic signals from nuclear explosions in outer space.** *Physical Review*, N. Y., 119(3):827–828, Aug. **1960.** 5 foot-refs. **DWB**—The thermal x-rays produced by a nuclear burst in outer space cause polarization currents in the medium which, if distributed anisotropically, will emit electromagnetic radiation. Roughly, a burst of thermal x-rays, equivalent in energy to 1 ton of high explosive, produces a detectable 10-Mc/sec signal at a range of 1 km. Since only the ratio of x-ray energy to range enters into the strength of the radiated signal, other ranges follow by adjusting the x-ray energy proportionately. This works up to $\sim 3 \times 10^3$ km; beyond this range, dispersive effects begin to reduce the signal received. The power in the electromagnetic signal varies as the square of the electron density, so this effect may provide a sensitive measure of the density of electrons in outer space. *Subject Headings:* **1. Nuclear explosions in outer space 2. Radio emission from nuclear explosions 3. Electron density in outer space.**—*Authors' abstract.* Ⓢ

11L–80 523.164:523.851:523.036.515

Pronik, V. I., **O maksimume teplovogo radioizlucheniia Galaktiki v napravlenii $l = 353°$, $b = 0°$.** [Maximum of galactic thermal radio emission at $l = 353°$, $b = 0°$.] *Astronomicheskii Zhurnal*, Moscow, 37(3):436–438, May/June **1960.** fig., 5 refs. Russian and English summaries p. 436. Transl. into English in *Soviet Astronomy AJ*, New York, 4(3):415–417, Nov./Dec. **1960. DLC**—Proceeding from the hypothesis on the connection in space between ionized and neutral hydrogen, a supposition is made that the maximum of thermal radio emission in the galactic plane at about $l = 353°$ may be due to HII zones. These hypothetical HII zones must be connected with the extremely rich and extended neutral hydrogen region, observed in the same direction, at a distance of 12–14 kps from the Sun. The mass of ionized hydrogen necessary to provide for the observed flux density of thermal radio emission would comprise only about 3% of the mass of neutral hydrogen localized in the region of the Galaxy. *Subject Headings:* **1. Galactic emissions 2. Hydrogen emission 3. Radio emission from galaxy.**—*Author's abstract.* Ⓢ

RADIO ASTRONOMY APPARATUS

See also: **San Francisco meeting, 1959** (Astron. Soc. Pacific), 11L–1; **Radio source measurements of 960 Mc/s** (Harris, Roberts), 11L–105.

11L–81 523.164.08

Covington, Arthur E., (*Natl. Res. Council, Ottawa*), **A compound interferometer.** *Royal Astronomical Society of Canada, Journal*, 54(1):17–28, Feb. **1960.** 5 figs., 4 eqs. **DLC**—The formation of a single-lobed fan-shaped receiving pattern for a radio telescope has been accomplished by combining several individual interference patterns. The antenna described is 600 feet long, forms a pattern 2 degrees N-S by 1.2 minutes E-W at an operating wave length of ten centimeters and is used for solar noise observations at the National Research Council, Ottawa. Preliminary interpretations of some of the scanning curves of the solar disk suggest that the E-W extent of the radio emissive regions associated with the sunspots is seldom smaller than 1.5 minutes of arc. *Subject Headings:* **1. Radio telescopes 2. Solar radio noise.**—*E.Z.S.* Ⓢ

11L–82 523.164.32:523.164.08

Covington, A. E., (*Natl. Res. Council, Ottawa*), **Internal precision of the daily radio flux observations at 10.7 centimetres.** *Royal Astronomical Society of Canada, Journal*, 53(4):156–161, Aug. **1959.** 3 figs., 2 refs. **DLC**—The analysis of 815 simultaneous readings of the 10.7 centimeter solar flux obtained from two independent radiometers shows that the relative basic probable error of a single reading is $\pm 1\%$ for a single radiometer. This must be increased to $\pm 2\%$, or even $\pm 3\%$, to include errors in the recording meters and in the variable transmission of the weatherproof dipole. The total relative error to be applied to the monthly means of the series of observations which commenced in 1947 has the same value. *Subject Headings:* **1. Solar radio radiation observations 2. Radiometers.**—*Author's abstract.* Ⓢ

11L–83 523.164.08:535.417:621.396.6:523.164.

Suzuki, Shigemasa (*Tokyo Astron. Obs.*), **Multiphase radio interferometers for locating th sources of the solar radio emission.** *Astronomical Society of Japan, Tokyo, Publications*, 11(4):19 215, **1959.** 16 figs., 8 refs., numerous eqs. **DLC**—Multiphase radio interferometers, developed f the purpose of minimizing the ambiguity and simplifying the reduction procedure in locating t sources of the solar radio emission, are discussed. By simple eye-estimation, the relative positi can be deduced with an accuracy of 0.01 R⊙. *Subject Headings:* **1. Solar radio emissions 2. Rad interferometer techniques.**—*Author's abstract.* Ⓢ

11L–84 523.164.08:523.164.

Thompson, A. R. (*Harvard Radio Astron. Station, Fort Davis, Texas*), **Solar radio astronom at Fort Davis, Texas.** *American Geophysical Union, Transactions*, 40(4):406–408, Dec. **1959.** fi **DWB, DLC**—Established in 1956, the main purpose of the station is to provide a continuous reco of the radio bursts emitted by the active sun. The frequency range 25–580 Mc/sec is covered in fi bands, by five separate receivers. The equipment is switched on automatically at sunrise each da and each receiver sweeps through its band three times per second. Idealized examples of the recor of the four spectral types of solar radio bursts (noise storm, slow drift bursts, fast drift bursts, co tinuum outbursts) are presented. *Subject Headings:* **1. Radio astronomy observatories 2. Sol radio noise bursts.**—*E.K.* Ⓢ

11L–85 523.164.08:523.164.

Goodman, Nathaniel Roy (*Applied Physics Dept., Guidance Research Lab., Space Technolo Lab., Inc., Los Angeles*), **Measuring amplitude and phase.** *Advances in the Astronautical Science* New York, Vol. 5, **1959,** issued **1960.** p. 278–290. fig., 5 refs., 45 eqs. **DWB** (629.1388 A512pro **DLC** (QB1.A26)—Methods for determining amplitude and phase of moderately wide-band nois and of noise contaminated by extraneous noise are studied. It is shown that amplitude and phas can be determined from a suitable pair of finite moving averages on the sample noise record. Explic expressions for suitable moving averages are given. The methods described in this paper we needed in practice to determine amplitude and phase of radio star scintillation data. *Subject Hea ing:* **1. Radio star scintillation measurement techniques.**—*Author's abstract.* Ⓢ

RADIO WAVES FROM THE SOLAR SYSTEM

See also: **Daily radio flux at 10.7 cm** (Covington), 11L–82; **Interferometers for locating sources of solar radio emission** (Suzuki), 11L–83; **Solar radio astronomy at Fort Davis** (Thompson), 11L–84; **Indirect detection of solar flares** (Del Vecchio), 11L–261; **Sudden enhancement of atmospherics** (Kamada), 11L–265; **Limb surges accompanied by x-ray emission** (Kleczek, Křivský), 11L–266; **Optical and radio emission of solar corona** (Genevyshev), 11L–290; **Observations on the solar eclipse of Oct. 2, 1959** (Aarons et al.), 11L–313.

11L–86 551.506.22:523.164.3

Koeckelenbergh, A., **Les observations solaires à l'Observatoire royal de Belgique pendan l'Année Géophysique Internationale.** [Solar observations at the Royal Observatory of Belgiu during the International Geophysical Year.] *Ciel et Terre*, Brussels, 76(5/6):191–192, May/Jun **1960.** plate. **DWB, DLC**—Short report on the activity of the Service of Solar Physics and Radi Astronomy of the Royal Observatory of Belgium during the International Geophysical Year. Surve of the photospheric observations made at Uccle and of the observations made with radio-telescope on 169 MHz and 600 MHz at Humain. *Subject Headings:* **1. IGY solar activity program 2. Radi astronomy observations 3. Photosphere 4. Uccle, Belgium 5. Humain, Belgium.**—*A.V.* Ⓢ

11L–87 523.164.32:523.74

Covington, Arthur E. and Harvey, Gladys A. (*both, Nat'l. Res. Council, Ottawa*), **The visibility the 10-cm radio-emissive region and its application in finding the 10-cm quiet sun.** *Astrophysic Journal*, Chicago, 132(2):435–451, Sept. **1960.** 10 figs., 3 tables, 13 refs., 2 eqs. **DWB, DLC**—Th 10-cm radio emission from 26 individual regions of sunspot activity was measured at the Nationa Research Council, Ottawa, Canada, with an 8-minute-of-arc fan-shaped antenna beam during portion of 1952 when relatively few sunspots were present. On the average, the radio-emissive regio appears on the eastern limb from 1 to 2 days before the visible sunspots and remains from 1 to 2 day longer on the western limb; the radio emission attains its maximum value 2 days before the regio reaches the central meridian, and the sunspot area 4 days before the region reaches the centra meridian. For individual regions of radio emission, a scatter diagram of radio flux versus sunspo area shows that there is a component of emission which is independent of area. This has led to a ne

expression in which the total daily flux from the solar disk is expressed empirically as the sum of three components: the first is the solar background, the second is related to the number of sunspot groups upon the disk, and the third is related to the area of the sunspots present. Values for the quiet sun for the years 1948–1956 have been derived. *Subject Headings:* **1. Solar radio emissions 2. Sunspot radio radiation.**—*Authors' abstract.* Ⓢ

11L–88 523.164.32 :523.755

Pisareva, V. V. (*Gor'kiĭ St. Univ.*), **Fluctuations in the intensity of radio emissions scattered by coronal irregularities.** *Soviet Astronomy AJ*, New York, 3(3) :419–424, Dec. **1959.** fig., 12 refs., 10 eqs. **DLC** Transl. of **O kolebaniiakh intensivnosti radioizlucheniia, rasseiannogo na koronal'nykh neodnorodnostiiakh,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(3) :427–433, May/June **1959. DLC**—Simultaneous observations of solar radio emissions made at two points separated in longitude (Gor'kiĭ and Irkutsk) at a frequency of 260 Mc, are described. The experiment was carried out in order to detect fluctuations in intensity of diffractive origin. The observations failed to reveal any fluctuations at a precision of up to 2% of the mean level of solar radio emissions. The circumstance may be associated with the fact that radio emission sources on the sun are of too large angular dimensions. It is shown that observations made with an antenna having an effective area of the order of 200 m^2, and an equipment with a fluctuation threshold of 2° sensitivity, with a time constant of 1 sec, might have led to the detection of such fluctuations even for wide-angle sources. The variation in the distribution is considered for an angle of radiation passing through a layer containing irregularities, as a function of the distance of the observer to the layer. The results obtained are applied to the scattering of radio emission from Tauri A on coronal irregularities. It is shown that at great distances from the center of the sun, the apparent increase in the size of the source is not to be explained by scattering on coronal rays. It must be assumed that there also exist irregularities of finer scale in the corona. *Subject Headings:* **1. Solar radio emissions 2. Corona structure.**—*Author's abstract.* Ⓢ

11L–89 523.164.32

Hokkyo, Noboru (*Hitachi Central Research Lab.*), **Induced cyclotron model of nonthermal solar radio emission.** *Astronomical Society of Japan, Tokyo, Publications*, 12(1) :28–41, **1960.** 4 figs., 13 refs., 35 eqs. **DLC**—It is suggested that the various components of nonthermal solar radio spectrum in the meter wave range may be interpreted in terms of a single mechanism in which the radiation is emitted by those electrons executing distorted helical motions around the magnetic lines of force under the combined action of the magnetic field and periodic electric fields associated with space charge waves excited by the leading surge of corpuscular disturbances or shock waves moving through the solar atmosphere. The radiation contains generally both extraordinary and ordinary waves. The ordinary wave can escape through the solar atmosphere without a stopping region. On the other hand, it is shown that the extraordinary wave, which rotates in the same direction as the free cyclotron motion of electrons, may or may not escape the solar atmosphere depending on whether the solar atmosphere is disturbed by the corpuscular streams or not. The association of unpolarized bursts, Type II or Type III bursts, with the corpuscular streams or shock waves may thus be understood. Polarized bursts, which do not show the frequency drift, will be emitted when corpuscular streams are ejected perpendicularly to the magnetic field whose strength is so large that the velocity of associated Alfvén wave exceeds that of corpuscular disturbances. The observed intensity variation on single-frequency record of bursts may be interpreted in terms of successive formation and decay of plasma wave packet. The intensity of outbursts is reasonably accounted for by the induced cyclotron model. *Subject Headings:* **1. Solar radio emissions 2. Solar radio noise bursts.**—*Author's abstract.* Ⓢ

11L–90 523.164.32

Vitkevich, V. V.; Gorelova, M. V. and Lozinskaia, T. A. (*all, Acad. Sci., U.S.S.R.*) **The spectrum of peaks in solar radio emission.** *Soviet Astronomy AJ*, New York, 3(4) :626–627, Jan./Feb. **1960.** fig., 6 refs. **DLC.** Transl. of **Spektr pichkov radioizlucheniia Solntsa,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(4) :641–642, July/Aug. **1959. DLC**—Two types of short duration bursts of solar radio frequency emission are described: narrow band width peaks with a band width ranging to 5 Mc, and wide banded peaks with a band width of the order of 12 15 Mc. *Subject Heading:* **1. Solar radio emissions.**—*Authors' abstract.* Ⓢ

11L–91 523.164.32

Bolischot, A.; Haddock, F. T. and Maxwell, A., **Spectrum of November 4, 1957 solar outburst.** *Annales d'Astrophysique*, Paris, 23(3) :478–479, May/June **1960.** plate, 3 refs. French, English and Russian summaries p. 478. **DWB, DLC**—The dynamic spectra of the abnormal radio emission received from the Sun on Nov. 4, 1957 are presented. The identity between records taken at two remote stations gives an evidence for an origin of the intensity fluctuations very close to the Sun.

Some of their characteristics may give a clue to the explanation of the phenomenon. *Subject Headings:* **1. Radio astronomy 2. Solar radio radiation 3. Solar radio noise bursts.**—*Authors' abstract.* Ⓢ

11L–92 523.164.32:523.755:551.521.67

Blum, E. J. and Malinge, A. M., **Etude des positions relatives des sources d'orage radioélectrique solaire et des centres d'activité optique associés.** [Study of the relative positions of solar radioelectric storm sources and associated optical activity centers.] *Académie des Sciences, Paris, Comptes Rendus,* 250(19):3119–3121, May 9, **1960.** 2 figs., 3 refs. **DWB, DLC**—Solar radioelectric storm sources observed on 169 MHz are compared with optical spots. This comparison of the relative average positions of radio and optical centers made it possible to estimate the average altitude of the storm centers and to put into evidence a systematic departure between their apparent position and their true position in the sun's corona. It is found that for the most intense storm centers there exists an effect of directivity in latitude. *Subject Headings:* **1. Solar radio emissions 2. Solar radioelectric storms 3. Sun's corona.**—*A.V.* Ⓢ

11L–93 523.164.82:523.746

Maxwell, Alan; Howard, W. E., III and Garmire, G. (*all, Radio Astron. St. of Harvard Coll. Observ., Ft. Davis, Texas*), **Some statistics of solar radio bursts at sunspot maximum.** *Journal of Geophysical Research,* Wash., D. C., 65(11):3581–3588, Nov. **1960.** fig., 7 tables, 8 refs., eq. **DWB, DLC**—This paper discusses the occurrence and intensity of solar radio bursts at four frequencies in the band 100 to 600 Mc/s. The observations cover 4010 hours during a 12-month period at sunspot maximum; the results refer essentially to bursts of intensity greater than 10^{-21} mks unit and duration greater than 0.3 second. The statistical information is interpreted in terms of the spectral characteristics of the bursts. The experimental data were taken at Fort Davis, Tex., and the analysis shows that at 125 Mc/s burst radiation was recorded for 560 hours, of which 380 hours were of low intensity. At 200 Mc/s the burst radiation covered 350 hours, of which 240 hours were of low intensity. For these two frequencies the bursts occurred mainly in the form of noise storms (spectral type I). At 425 and 550 Mc/s the total times of the solar bursts were much less, being respectively 21 and 23 hours; for the most part, however, this radiation was of high intensity and appeared in the form of continuum radiation (spectral type IV) over a wide frequency range. *Subject Headings:* **1. Solar radio noise bursts 2. Sunspot effects on radio noise bursts.**—*Authors' abstract.* Ⓢ

11L–94 523.164.32:523.75

Swarup, G. (*Stanford Univ., Calif.*); Stone, P. H. and Maxwell, Alan (*both, Harvard College Obs., Fort Davis, Texas*), **The association of solar radio bursts with flares and prominences.** *Astrophysical Journal,* Chicago, 131(3):725–738, May **1960.** 7 figs., 4 tables, 26 refs. **DWB, DLC**—Solar radio bursts in the frequency range 100–580 Mc/s have been correlated with solar optical phenomena over a 2-year period covering the present sunspot maximum. It is found that 60 percent of fast-drift (type III) radio bursts are coincident in time with solar flares. This figure is in accord with that obtained by previous investigators, but statistical studies show that only half this number of bursts are truly associated with flares: the remainder are associated by chance. The truly associated bursts usually occur between the start and the maximum of a flare. Intense bursts are more highly associated with flares than are weak bursts. In the reverse correlation—that of flares with radio bursts—it is found that 25 percent of all solar flares are apparently associated with fast-drift bursts, the probability of association increasing if the flare is of greater area or height, on the east side of the disk, or accompanied by a surge or spray. Almost all slow-drift bursts (Type II) and continuum (Type IV) events are associated with flares, often of large area and intensity, but there is no well-defined association between noise-storm bursts (Type I) and flares. Only a small proportion of ejective solar prominences are accompanied by radio bursts; this may result from the unfavorable geometry for radio propagation from the limb. Concerning the physical association of the flares and solar bursts, it is suggested that both phenomena result from an unidentified primary origin. The transfer of energy to coronal radio levels probably takes place at 10^5 km/sec in the case of the fast-drift bursts and at about 10^3 km/sec for the slow-drift bursts. *Subject Headings:* **1. Solar radio noise bursts 2. Radio noise bursts-solar flare relationships.**—*Authors' abstract.* Ⓢ

11–95 523.164.32:621.396.029.6

Kakinuma, Takakiyo (*Nagoya Univ.*) and Hiei, Eijiro (*Tokyo Astron. Obs.*), **Unusual decrease of microwave solar radio emission during flare on November 30, 1959.** *Astronomical Society of Japan, Tokyo, Publications,* 12(1):117–123, **1960.** 3 figs., 2 refs. Unusual decrease of microwave solar radio emission on Nov. 30, 1959 observed at the Research Institute of Atmospherics, Nagoya University is reported, together with the optical observations of the associated flare made at the Tokyo Astronomical Observatory. *Subject Heading:* **1. Solar radio emissions during flares.**—*Authors' abstract.* Ⓢ

11L–96 535.51:523.164.32

Takakura, Tatsuo (*Univ. of Tokyo*), **Polarized bursts and noise storms of solar radio emission. Pt. 2, Storm bursts and background continuum.** *Astronomical Society of Japan, Tokyo, Publications*, 11(2):55–70, **1959.** 7 figs., table, 4 refs., 53 eqs. **Pt. 3, The post-detection low frequency spectra of noise storms.** *Ibid.*, p. 71–78. 8 figs., 2 refs., 8 eqs. **DLC**—An attempt is made to explain the so-called background continuum of the noise storms as the superposition of many spikes which have an identical shape, occur at random and whose amplitudes are distributed according to a probability density. If two parameters, the frequency of occurrences of bursts and the range of distribution of the amplitude, change with time as they are likely to do, almost all noise storms are in fairly good agreement with the present hypothesis. In this case, so-called "storm bursts" are fluctuations about a mean level and the superposition of at least a few spikes. *Subject Headings:* **1. Solar radio noise burst polarization 2. Solar radioelectric storm.**—*Author's abstract.* Ⓢ

11L–97 523.164.32:621.396.029.6

Takakura, Tatsuo (*Tokyo Astron. Obs.*), **Microwave bursts of solar radio emission.** *Astronomical Society of Japan, Tokyo, Publications*, 12(1):55–62, **1960.** 5 figs., 3 refs. **DLC**—Wide-band compound dynamic spectra of solar radio outbursts have been studied in the frequency range from 9500 Mc to 67 Mc. The range of 9500–1000 Mc has been covered by the records at several fixed frequencies, and both the swept frequency records and fixed frequency records have been used on the frequencies below 1000 Mc. A typical outstanding outburst may be as follows. A short-lived burst whose duration is several minutes begins almost simultaneously at the frequencies above 1000 Mc. The flux density of the burst is maximum at about 9000 Mc–3000 Mc, decreases with decreasing frequency and is generally very weak on the frequencies below 1000 Mc. A few minutes later, a Type II burst begins in the meter wave region with a sharp high frequency cut-off which is usually below 350 Mc for the fundamental wave (and below 700 Mc for the second harmonic). Following the Type II burst, a broad-band Type IV burst begins and lasts one hour or two. The frequencies for the maximum flux density of the Type IV bursts distribute depending on the case from 200 Mc to 10,000 Mc. Above-mentioned short-lived burst at the frequencies above 1000 Mc is neither an extension of the Type II burst nor the same as the Type IV burst. It is a distinctive type of burst and may be called "Microwave burst" or "M-type" burst. In comparison with the current classification of bursts at microwave frequency, short-lived SD (Simple and Distinct) and CD (Complex and Distinct) bursts whose durations are less than about 10 minutes seem to be the "M-type" bursts, while long-lived CD bursts might be Type IV bursts. *Subject Headings:* **1. Solar radio emissions 2. Radio noise burst classification.**—*Author's abstract.* Ⓢ

11L–98 523.162:523.745:551.521.67:621.396.8

Malinge, Anne-Marie, **Relation entre la position et le sens de polarisation des orages radioélectriques solaires.** [Relationship between the position and direction of polarization in solar radioelectric storms.] *Académie des Sciences, Paris, Comptes Rendus*, 250(7):1186–1188, Feb. 15, **1960.** fig., 7 refs. **DWB, DLC**—Study of the polarization direction of the radiation from solar radioelectric storms according to their position on the solar disk. This study is based on observations made by means of the big interferometer at Nançay and on polarization measurements made at the Néra station (Netherlands). The inversion observed in the polarization direction can be related to the inversion of the general magnetic field of the sun. It appears, however, more likely to relate the polarization of storms to the magnetic field of the spots. It is known that the magnetic field configuration in the activity centers is the same for all the activity centers of a same hemisphere. The wider head spot has the most intense magnetic field; its polarity is opposite in the two hemispheres and changes at each activity cycle. *Subject Headings:* **1. Radio astronomy 2. Solar radioelectric storms 3. Sunspot magnetism.**—*A.V.* Ⓢ

11L–99 523.164.82:523.752

Malinge, Anne-Marie (*Observatoire de Meudon*), **Relation entre les orages radioélectriques solaires et les éruptions chromosphériques.** [Relationship between solar radio noise storms and solar flares.] *Annales d'Astrophysique*, Paris, 23(4):574 584, July/Aug. **1960.** 5 figs., 8 refs. French, English and Russian summaries p. 574. **DWB, DLC**—Comparison of the position of radio noise storms observed at 169 MHz with solar flares following or preceding the beginning of the noise storms shows a definite relation between the two phenomena. A notable effect of refraction is shown to exist in the corona. *Subject Headings:* **1. Solar radioelectric storms 2. Chromospheric eruptions 3. Radio noise bursts—solar flare relationships 4. Coronal refraction phenomena.**—*Author's abstract.* Ⓢ

11L–100 523.164.82 523.75.621.396.8

Rabben, H. H. (*Fraunhofer Inst., Freiburg i. Br.*), **Solare Bursts der Type III und ihre Beziehungen zu den Eruptionen.** [Solar bursts Type III and their relation to eruptions.] *Zeitschrift für*

Astrophysik, Berlin, 49(2):95–110, **1960.** 5 figs., 6 tables, 14 refs., several eqs. English summary p. 95. **DLC**—136 burst events of Type III have been recorded with the Freiburg radio spectrograph in a period of 200 hours. Their relation to 372 flares observed in the same period is studied. By the use of records obtained at other observatories, the spectral range was extended down to microwaves. About 20% of the flares coincided with Type III bursts, 88 of the remaining 96 burst events occurred within the lifetime of flares extended by ±5 min. It was found that: a) the greater the flare importance the greater the number of bursts per event. b) Great burst events obviously occur near the onset of a flare, while the occurrence of smaller events is independent of the flare's phase. c) Burst intensity and frequency drift/sec increase with the total spectral range of the burst. e) The center-limb decrease of the number of bursts exceeds that of flares and in addition shows a strong east-west asymmetry. f) The contribution of bursts of medium intensity and frequency drift/sec increases strongly with central meridian distance. g) The radio-efficiency of flares increases with importance. h) Burst-producing flares prefer certain centers of activity. *Subject Headings:* **1. Solar radio noise bursts 2. Radio noise bursts—solar flare relationships.**—*Author's abstract.* Ⓢ

11L–101 523.74 523.164.82

Giovanelli, R. G. (*Commonwealth Sci. & Ind. Research Org., Sydney*), **Flare surges, puffs and type III bursts.** *Nuovo Cimento*, Bologna, Supplement No. 1 to Ser. 10, Vol. 13, **1959.** p. 302–304. 2 figs., table, 3 refs. **DLC**—The mode of origin, direction of motion and some physical conditions of flare surges are examined by the relationship between flare and surge in connection with physical conditions in surges. As illustrated by cinematograph studies the surge comes out of the flare region itself and the expansion of flare occurs at the initial stages of ejection in a particle stream, finally an opaque region develops. The frequency decreases rapidly in a Type III burst, due to a disturbance passing through the solar corona. Surges and Type III bursts occur frequently with flares. Some flare surges show an explosive character. Puffs with Type III bursts and the number of flare puffs are shown on the table. *Subject Headings:* **1. Solar flares 2. Radio noise bursts-solar flare relationships.**—*O.T.* Ⓢ

11L–102 523.164.32:523.165:621.396.8(98/99)

Kundu, M. R. and Haddock, F. T. (*both, Univ. of Mich. Obs., Ann Arbor*), **A relation between solar radio emission and polar cap absorption of cosmic noise.** *Nature*, London, 186(4725):610–613, May 21, **1960.** 3 figs., 3 tables, 7 refs. **DWB**—A statistical study of the nature of centimeter and meter-wave solar radio outbursts associated with polar cap absorption and a general conclusion for the prediction of proton events is presented. An analysis of 31 events of polar cap absorption, illustrated by tables and diagrams, shows a close correlation between the presence on the sun of the sources of broad-band centimeter-wave outbursts or Type IV events, and the probability that these "active regions" play some part in the storage or trapping of the protons responsible for absorption events in the polar regions. *Subject Headings:* **1. Solar radio emission 2. Cosmic radio noise absorption 3. Solar radio noise bursts.**—*O.T.* Ⓢ

11L–103 523.164.34

Zelinskaia, M. R.; Troitskiĭ, V. S. and Fedoseev, L. I. (*all, Gor'kiĭ Univ.*), **Lunar radio emissions at 1.63 cm wavelength.** *Soviet Astronomy AJ*, New York, 3(4):628–632, Jan./Feb. **1960.** 2 figs., 13 refs., 9 eqs. **DLC.** Transl. of **Radioizluchenie Luny na volne 1.63 cm,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(4):643–647, July/Aug. **1959. DLC**—Measurements were taken of the temperature of radio emissions from the central portion of the lunar disc, at 1.63-cm wave length, as a function of lunar phase. The relationship displayed a sufficiently good approximation to the expression $T_C = 224 - 36° \cos(\Omega t - 40°)$. The value of the attenuation coefficient $\kappa = 0.2$ cm^{-1} of the electromagnetic wave, and the value of the equivalent conductivity $\sigma = 7.9 \cdot 10^3$ CGSE of lunar rock, were derived from a comparison with the theoretical relationship. *Subject Heading:* **1. Radio emission from moon.**—*Authors' abstract.* Ⓢ

11L–104 523.164.355

†Roberts, J. A. and Stanley, G. J. (*both, Calif. Inst. of Tech. Radio Obs., Owens Valley*), **Radio emission from Jupiter at a wavelength of 31 centimeters.** *Astronomical Society of the Pacific, San Francisco, Publications*, 71(423):485–496, Dec. **1959.** 4 figs., 22 refs., 3 eqs. **DLC**—This is a report of a series of observations at a wave length of 31 cm and discussion of their implications. The observations were made with a 90-foot equatorially mounted radio telescope between April 15 and June 17, 1959. The observed intensities are graphically represented. The paper does not arrive at any definite conclusion with respect to the origin of the high-intensity decimeter radiation from Jupiter. *Subject Heading:* **1. Radio emission from Jupiter.**—*I.S.* Ⓢ

RADIO WAVES FROM OUTSIDE THE SOLAR SYSTEM

See also: **Radio emissions scattered by coronal irregularities** (Pisareva), 11L–88; **Solar radio emission and polar cap absorption of cosmic noise** (Kundu, Haddock), 11L–102; **Galactic nebulae in radio-frequency and optical regions** (Aller), 11L–347; **Radio observations of emission lines of interstellar hydrogen** (Pskovskiĭ), 11L–369.

11L–105 523.164.42

Harris, D. E. and Roberts, J. A. (*both, Calif. Inst. of Tech. Radio Obs., Owens Valley*), **Radio source measurements of 960 Mc/s.** *Astronomical Society of the Pacific, San Francisco, Publications*, 72(427):237–255, Aug. **1960.** 2 figs., table, 14 refs. **DLC**—This is a study of 106 radio sources made with one of the equatorially mounted 90-foot paraboloids of the Owens Valley Radio Observatory at a frequency of 960 Mc/s. The text is divided into seven sections. Following the introduction section, Section II briefly describes the equipment. In sections III and IV the methods of determining the positions and intensities of the sources are outlined. The suggested optical identifications are discussed in section V while section VI is devoted to a consideration of the spectra of the data. The final section consists of conclusions. The main result of the study is claimed to be a reliable catalogue of sources that will be used as a "finding list" for precise position measurements. The positions, intensities and other pertinent data for the 106 sources are tabulated at the end of the article. *Subject Heading:* **1. Radio star catalogue.**—*I.S.* Ⓢ

11L–106 523.854:537.12 523.164.42

Syrovatskiĭ, S. I. (*Acad. Sci., U.S.S.R.*), **The distribution of relativistic electrons in the galaxy and the spectrum of synchroton radio emission.** *Soviet Astronomy AJ*, New York, 3(1):22–38, Jan./Feb. **1959.** 2 figs., 10 refs., 91 eqs. **DLC.** Transl. of **Raspredelenie relativistskikh elektronov v Galaktike i spektr magnitotormoznogo radioizlucheniia,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(1):17–32, Jan./Feb. **1959. DLC**—The problem of the diffusion of particles is solved, taking into account the regular changes of the particle energy during this process. The spatial distribution and the energy spectrum of electrons, whose energy changes because of radiation emission in the magnetic field, was found on the assumption that the sources occupy an ellipsoidal volume and inject into interstellar space relativistic electrons with an energy spectrum $QE^{-\gamma_0}$. The case when the distribution of the sources coincides with the flat subsystem of the galaxy and $\gamma_0 = 2$ is considered in detail. The energy spectra of electrons along the line of sight in different directions and the corresponding intensities of synchrotron radiation were calculated. It is shown that the energy spectrum of electrons along the line of sight can be represented in a limited energy region by the expression $KE^{-\gamma}$, where γ varies within the limits $2 < \gamma < 3$, depending on the choice of the diffusion coefficient. The choice of the diffusion coefficient of relativistic particles in interstellar space equal to $D = 10^{29}$ cm/sec and the intensity of the sources (the coefficient in the source spectrum) $Q = 10^{38}$ ergs/sec give agreement between the theoretical and observed spectra of nonthermal radio emission of the galaxy in the frequency region $\nu > 10$ Mc. *Subject Headings:* **1. Radio emission from galaxy 2. Electron density in outer space.**—*Author's abstract.* Ⓢ

11L–107 523.164.42:523.877

Getmantsev, G. G. (*Gor'kiĭ St. Univ.*), **The determination of the mean dimensions of magnetized clouds of interstellar gas by radioastronomical methods.** *Soviet Astronomy AJ*, New York, 3(3): 415–418, Dec. **1959.** 5 refs., 4 eqs. **DLC.** Transl. of **Opredelenie srednego razmera namagnichennykh oblakov mezhzvezdnogo gaza radioastronomicheskimi metodami.** *Astronomicheskiĭ Zhurnal*, Moscow, 36(3):422–426, May/June **1959. DLC**—The possibility is discussed of the determination of the mean dimensions of magnetized clouds of interstellar ionized gas from measurements of the polarization of nonthermal radio radiation and from measurements of the intensity fluctuations of radio radiation, when the directional pattern of the radio telescope is swept across the sky. On the basis of published data, it is shown that $l \lesssim 75$ pc. *Subject Headings:* **1. Interstellar matter 2. Stellar radio emission 3. Polarization of radio waves.**—*Author's abstract.* Ⓢ

11L–108 523.164.42

Drake, Frank D. (*Natl. Radio Astron. Obs*), **Radio resolution of the galactic nucleus.** *Sky and Telescope*, N. Y., 18(8):428–429, June **1959.** figs. (incl. photo). **DWB, DLC**—The radio emission known as Sagittarius A is one of the most intense in the sky. An experiment is described here, resolving Sagittarius A into four components. The results obtained require a revision of the ideas regarding physical structure of the galactic nucleus. W. A. Baade has found the central nucleus of Andromeda Spiral to consist of small bodies, 20 parsecs in diameter. If further investigations prove true, 22-cm position of Sagittarius A is not the position of nucleus and new zero point of galactic longitude differs by several minutes of arc from galactic center. *Subject Headings:* **1. Galactic structure 2. Radio stars.**—*A.H.K.* Ⓢ

11L–109 523.164.42:523.854.1

Field, George B. (*Princeton Univ. Obs.*), **Radio continuum emission by spiral arms.** *Astronomical Society of the Pacific, San Francisco, Publications*, 72(427):303–307, Aug. **1960.** 3 figs., 4 refs., eq. **DLC**—MILLS proposed a model of the spiral arms of the galaxy that explains certain features of the observed radio continuum emission. This paper discusses the model and offers suggestions with respect to some difficulties which MILLS pointed out. It is suggested, and illustrated by an example, that the difficulties may be resolved by taking into account the path length through the spiral arm as well as the emissivity pattern and, therefore, MILLS' model is even better than he supposes. *Subject Headings:* **1. Galactic structure 2. Radio emission from galaxy.**—*I.S.* Ⓢ

11L–110 523.164.42:523.854

†Mills, B. Y. (*C. S. I. R. O. Radiophysics Lab., Sydney, Australia*), **The radio continuum radiation from the galaxy.** *Astronomical Society of the Pacific, San Francisco, Publications*, 71(421):267–291, Aug. **1959.** 8 figs., table, 34 refs., 9 eqs. **DLC**—This paper discusses the radio emission arising in the Milky Way in the light of more recent systematic studies of the Milky Way with the help of new large instruments. Two processes related to galactic continuum emission are reviewed. First the thermal process by which the ionized interstellar gas radiates in the continuum by free-free transitions is briefly discussed. The remainder of the article is concerned with nonthermal emission. The text is illustrated by graphic representations. *Subject Headings:* **1. Radio emission from galaxy 2. Milky Way.**—*I.S.* Ⓢ

11L–111 523.164.42

Shklovskiĭ, I. S., **O vozmozhnom vekovom izmenenii potoka i intensivnosti radioizlucheniia ot nekotorykh diskretnykh istochnikov.** [Secular variation of the flux and intensity of radio emission from discrete sources.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(2):256–264, March/April **1960.** table, 13 refs., 16 eqs. Russian and English summaries p. 256. **DLC.** Transl. into English in *Soviet Astronomy AJ*, New York, 4(2):243–249, Sept./Oct. **1960. DLC**—The dependence of the flux and brightness on radius is obtained for expanding nebulae—the remnants of supernova outbursts—on the basis of the synchrotron mechanism of radio emission, and also some simple theoretical considerations. It is shown that this dependence has the form: $F_\nu \propto r^{-\beta}$, $I_\nu \propto r^{-(\beta+2)}$, where β, in particular, depends on the exponent of the spectrum of the source. For different sources, β varies within the limits 3.2 (Crab Nebula) to 7 (remnants of the outburst of the 1604 supernova). The conclusion is reached that the flux of radio emission from Cassiopeia A should decrease annually by about 2%. The present-day technique of radio astronomical observations permits the effect deduced by theory to be detected. The fact that galactic sources have a smaller spectrum exponent than the extragalactic sources is explained. The intensity of emission from remnants of outbursts at different stages of evolution is considered. At comparatively early stages, the emission should be exceedingly large. It is concluded that the possibility of observations of radio emission from supernovae of 1885 and 1895 in M 31 and NGC 5253 is not excluded. *Subject Headings:* **1. Radio emissions from discrete sources 2. Secular radiation variations.**—*Author's abstract.* Ⓢ

11L–112 535.51:523.164.42

Kuz'min, A. D. and Udal'stov, V. A. (*both, Acad. Scien., U.S.S.R.*), **An investigation of the polarization of the 10 cm radiation of the Crab nebula.** *Soviet Astronomy AJ*, New York, 3(1):39–45, Jan./Feb. **1959.** 8 figs., 17 refs., eq. **DLC.** Transl. **Issledovanie poliarizatsii radioizlucheniia krabovidnoĭ tumannosti v 10-cm diapazone voln,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(1):33–40, Jan./Feb. **1959. DLC**—The polarization of the radio radiation of the Crab nebula at a wavelength of 9.6 cm has been measured. The measurements were made with the 31 m radio telescope with the help of a polarizing radiometer. The sensitivity of the radiometer was equal to 0.6–0.9°K for a bandwidth of 10 Mc (with an image channel and a time constant of 20 sec.). The antenna temperature of one component of nonpolarized radiation was equal to $T_a = 100°$. Several instrumental factors causing spurious polarization effects were considered and taken into account. Linear polarization of the radio radiation of the Crab nebula has been detected. The degree of polarization is $(3 \pm 0.5)\%$. The preferred plane of polarization lies at a position angle $\varphi = 142° \pm 5°$, and this coincides with the direction of the greatest extension of the Crab nebula. The depolarizing effects of the interstellar medium and of the Crab nebula itself have been estimated. *Subject Headings:* **1. Radio emission from nebulae 2. Crab nebula 3. Polarization of radio waves.**—*Authors' abstract.* Ⓢ

11L–113 523.164.42

Broten, N. W. and Medd, W. J. (*both, Natl. Res. Council Ottawa*), **Absolute flux measurements of Cassiopeia A, Taurus A, and Cygnus A, at 3200 mc/s.** *Astrophysical Journal*, Chicago, 132(2):279–285, Sept. **1960.** 2 figs., 2 tables, 14 refs., 4 eqs. **DWB, DLC**—Measurements of the radio flux density from the three brightest radio sources are described. The flux was determined with reference

to the thermal radiation from a heated load and the gain of a 4 ×3-foot-aperture horn antenna. The experimental technique eliminated the necessity of determining the background temperature. The accuracy is examined in detail, and a probable error of 4 or 5 per cent is assigned to the flux values. In units of 10^{-25} watt m^{-2} $(c/s)^{-1}$, values of flux density for Cassiopeia A, Taurus A, and Cygnus A are, respectively, 134, 71, and 68. *Subject Heading:* **1. Radio stars.**—*Author's abstract.* Ⓢ

11L–114 523.164.42:523.854

Radhakrishnan, V. (*Calif. Inst. of Tech. Radio Obs., Owens Valley*), **Self-absorption in the 21-cm radiation from galactic neutral hydrogen.** *Astronomical Society of the Pacific, San Francisco, Publications*, 72(427):296–302, Aug. **1960.** 3 figs., 7 refs., 2 eqs. **DLC**—The existence of clouds of neutral hydrogen at temperatures of galactic HI regions causes the occurrence of self-absorption in the 21-cm radiation. This is substantiated by the observation reported in this paper in which self-absorption due to hydrogen was detected at a temperature no greater than 60°K. The observations were made on two nights with a frequency-switched radiometer in conjunction with a 90-foot equatorially mounted paraboloid. Samples of different types of 21-cm records related to these observations are discussed and graphically illustrated. *Subject Heading:* **1. Radio emission from galaxy.**—*I.S.* Ⓢ

11L–115 523.164.43:523.16

Brengauz, G. E., **K obnaruzheniiu absorptsionnoĭ radiolinii mezhzvezdnykh molekul CH.** [Detection of the absorption radio line of interstellar CH molecules.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(3):584–586, May/June **1960.** 3 tables, 8 refs., 5 eqs. Engl. summary p. 584. **DLC.** Transl. into English in *Soviet Astronomy AJ*, New York, 4(3):554–556, Nov./Dec. **1960. DLC**—This note demonstrates the possibility of detecting radio lines due to absorption of radiation from radio stars by interstellar CH molecules. The frequency of the transition between components of the $J=\frac{1}{2}\lambda$ doublet of the $^2\Pi_{\frac{1}{2}}$ state was determined with greater precision from studies of monochromatic cometary radiation. *Subject Headings:* **1. Stellar radio radiation absorption 2. Radio stars 3. Absorption of radio waves 4. Radio line emissions.**—*Author's abstract.* Ⓢ

11L–116 523.164.42

Davies, R. D. and Jennison, R. C. (*both, Univ. of Manchester*), **Red-shift absorption spectrum of the Cygnus-A radio source.** *Nature*, London, 184(4689) Supp. No. 11:803–804, Sept, 12, **1959.** fig., 3 refs. **DWB**—A report of a measurement to check the 21-cm hydrogen line absorption spectrum of Cygnus-A, made with a hydrogen-line receiver in conjunction with the 250-ft radio telescope at Jodrell Bank. The measurements made in two groups using the receiver in different modes of operation to eliminate spurious effects, are discussed and graphically represented. It is concluded that these measurements do not confirm the Lilley and McClain observations. The radio frequency confirmation of the distance of Cygnus-A is no longer valid and the measurements provide no check that the radio and optical cosmological red-shift-velocities are the same. *Subject Headings:* **1. Stellar radio radiation absorption 2. Radio stars.**—*I.S.* Ⓢ

11L–117 523.164.42

Kardashev, N. S. (*P. K. Shternberg St. Astron. Inst.*), **On the possibility of detection of allowed lines of atomic hydrogen in the radio-frequency spectrum.** *Soviet Astronomy AJ*, New York, 3(5):813–820, March/April **1960.** 5 tables, 7 refs., 18 eqs. Transl. of **O vozmozhnosti obnaruzheniia razreshennykh liniĭ atomarnogo vodoroda v radio-diapazone,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(5):838–844, Sept./Oct. **1959. DLC**—The emission of hydrogen lines due to transitions between levels with large quantum numbers n is considered. It is shown that transitions of the type $n \rightarrow n-1$ have the highest transition probability. The oscillator strength of such transitions is $f=n/6$, which is several orders of magnitude higher than the oscillator strength for transitions between components of fine and superfine structure. The estimate of intensity shows that the lines can be observed in the far infrared up to decimeter wave lengths. *Subject Headings:* **1. Hydrogen lines 2. Stellar radio radiation absorption 3. Radio line emissions.**—*Author's abstract.* Ⓢ

11L–118 523.164.42

Mizushima, M. (*Dept. Physics, Univ. Boulder, Colo.*), **Theory of the radio-frequency spectra of the H_2^+ molecule-ion.** *Astrophysical Journal*, Chicago, 132(2):493–501, Sept. **1960.** 2 figs., 4 tables, 9 refs., 25 eqs. **DWB, DLC**—The possible radio-frequency spectrum of the H_2^+ molecule-ion is calculated. The lowest rotational state ($N=0$) is a para state, and there is no hyperfine structure, but the next state ($N=1$) is an orthostate and splits into five levels because of the hyperfine interaction. The frequencies and intensities of transitions among these five levels are calculated. The predicted resonance frequencies are 1438.0, 1400.1, 1393.8, 1320.7, 1282.8, 44.2, and 37.9 in Mc/s. The g-factor for each level is also calculated. *Subject Headings:* **1. Radio frequency radiation 2. Hydrogen spectra 3. Radio line emission.**—*Author's abstract.* Ⓢ

ASTRONOMICAL ECHOES

See also: **Radio echoes from meteors,** 11L–168 to 11L–185; **Velocity of meteors of Geminid shower** (Dudnik et al.), 11L–192; **Radar observation of Perseids during 1957** (Fialko), 11L–193.

11L–119 523.164.8

Eshleman, V. R. and Peterson, Allen M., **Radar astronomy.** *Scientific American,* N. Y., 203(2):50–59, Aug. **1960.** 10 figs. **DWB, DLC**—Powerful radio transmitters use giant antennas to send out pulses of electromagnetic energy. These make direct contact with the object of study and return to the sender. The return is compared with the original and deductions are made about the bodies or regions investigated. The special forte of radar is the accurate measurement of distance. Further advances in technology should make it possible to construct maps of the planets. A radar map of the moon in preliminary form is shown. Some of the radar astronomy stations now operating and some being built are described. The radar system used to study the sun showed that important solar studies can be made with systems now under construction. The study of whistlers and various outer-atmospheric phenomena will be advanced with radar studies and with further advances in radar technology. *Subject Heading:* **1. Radar astronomy.**—*E.Z.S.* Ⓢ

11L–120 523.164.82 551.501.81:523.7

Eshleman, V. R.; Barthle, R. C. and Gallagher, P. B. (*all, Space Radioscience Lab., Stanford Univ.*) **Radar echoes from the sun.** *Science,* Wash., D. C., 131(3397):329–332, Feb. 5, **1960.** 2 figs., 4 refs. **DLC**—Describes efforts made to obtain radar echoes from the sun. The radar detector requires an optimum frequency of 30 megacycles per second. The travel time of radar pulse to the sun and back to the earth is about 1000 seconds. The echo energy is spread over 2000 cycles per second of which solar rotation alone accounts for much. *Subject Heading:* **1. Radar echoes from sun.**—*A.H.K.* Ⓢ

11L–121 523.164.8:523.42 551.501.81:523.42

Evans, J. V. and Taylor, G. N. (*both, Jodrell Bank Exp. Station, Univ. of Manchester*), **Radio echo observations of Venus.** *Nature,* London, 184(4696):1358–1359, Oct. 31, **1959.** fig., 2 refs. **DLC, DWB**—During Sept, 1959 an attempt was made to observe radio echoes from the planet Venus using the 250 ft radio telescope at Jodrell Bank. The radar equipment used with the telescope operated at 408.00 Mc/s; transmitted power was 50 kW; pulse-length was 30 msec and pulse repetition rate 1 per sec; receiver noise figure was 4.6 db and band width 60 cps. The equipment failed to detect echoes stronger than the noise level so integrating equipment was used to make an analysis of the signals for echoes weaker than the receiver noise-level. Results given are not in agreement with the work of R. Price et al. (*Science,* 129:751, **1959**) which suggested that the radar cross-section of Venus was equal to the physical area presented by its disk. *Subject Headings:* **1. Radar echoes from Venus 2. Venus 3. Jodrell Bank, Eng.**—*A.J.M.* Ⓢ

11L–122 523.164.83

Brown, Walter, E., Jr. (*Calif. Inst. Tech. Pasadena*), **A lunar and planetary echo theory.** *Journal of Geophysical Research,* Wash., D. C., 65(10):3087–3095, Oct. **1960.** 4 figs., table, 3 refs., 56 eqs. **DLC**—The lunar radar echo is divided into specular and Lambert scatter components, the specular component being derived from a statistical model of the lunar surface. The theoretical impulse response is compared with experimental data from Trexler, and the theoretical frequency response is compared with some preliminary Goldstone moonbounce experimental data. The theory indicates that the Lambert component will be visible at high power levels and would probably become apparent about 1000 μsec after the leading edge of the echo. A value for reflectivity of 0.01 found from the level of the scatter component is used to derive an estimate of some of the average properties of the lunar surface. *Subject Headings:* **1. Radar echoes from moon 2. Radar echoes from planets.**—*Author's abstract.* Ⓢ

11L–123 523.164.83:551.501.81:551.510.536:523.36

Eshleman, V. R.; Gallagher, P. B. and Barthle, R. C. (*all, Radioscience Lab. Stanford Univ.*), **Radar methods of measuring the cislunar electron density.** *Journal of Geophysical Research,* Wash., D. C., 65(10):3079–3086, Oct. **1960.** 16 refs., 10 eqs. **DLC**—The ionized medium between the earth and the moon is being studied at Stanford by means of lunar radar echoes. Of prime interest is the electron density beyond the earth's ionosphere, in regions (at distances of several to 60 earth radii) where the interplanetary gas may be dominant. Six related techniques for measuring the total integrated electron density are discussed. In practice the ionospheric part could be determined separately and subtracted from the total. These same techniques could be used to measure by radar the electron density between the earth and various planets, and to measure by one-way propagation the integrated electron density between a space probe and the earth. The moon's radar range

exceeds the true range, especially at low frequencies, because of group retardation, which is a measure of integrated electron density. Density measurements based on absolute measures of radar range would require very high peak power (for pulse ranging) or very high equipment stability (for CW ranging); furthermore, the true lunar range is not known accurately. In two of the methods described here, the full average-power capability of the transmitter can be used without need for high stability or precise knowledge of the lunar range. In effect, a reference is sent with the measuring quantities and only relative radar range is measured. Doppler frequency shifts and the earth's magnetic field cause only slight difficulties. However, path splitting, electron 'blobs,' and lunar surface irregularities possibly could affect the waves more than the electrons do. The measurements might then yield information about the lunar surface or about the temporal and spatial variations of the cislunar medium. *Subject Headings:* **1. Radar echoes from moon 2. Electron density in outer space 3. Ionized media.**—*Authors' abstract.* Ⓢ

11L–124 523.164.83:551.510.62:621.396.9

Fricker, S. J.; Ingalls, R. P.; Mason, W. C. et al., **Computation and measurement of the fading rate of moon-reflected UHF signals.** *U. S. National Bureau of Standards, Journal of Research, Sec. D*, 64(5):455–465, Sept./Oct. **1960.** 11 figs., table, 8 refs., 41 eqs. **DWB, DLC**—A method is described for predicting the fast fading rate of moon-reflected signals. It is based entirely upon considerations of the observer-moon positions and relative motions. Experimental results which are in good agreement with the computed fading rates have been obtained from a moon-reflection experiment at a frequency of 412 megacycles per second. Some possible implications of this method of interpreting fading rates are given. *Subject Headings:* **1. UHF radio wave propagation 2. Radio echoes from moon. I. Stone, M. L. II. Swift, D. W.**—*Authors' abstract.* Ⓢ

11L–125 523.164.83

Leadabrand, R. L.; Dyce, R. B.; Fredriksen, A. et al. (*all, Stanford Res. Inst., Menlo Park, Calif.*), **Evidence that moon is a rough scatterer at radio frequencies.** *Journal of Geophysical Research*, Wash., D. C., 65(10):3071–3078, Oct. **1960.** 10 figs., table, 7 refs., eqs. **DLC**—Radar echoes from the moon have been observed at 400 Mc/s for the purpose of determining the scattering properties of the moon. The results go beyond the investigations of other authors who claim that the moon is a quasi-smooth reflector having a range depth of less than 600 μsec. Results described in this report indicate that, although the moon behaves as a quasi-smooth reflector in the 0- to 600-μsec range depth, beyond this range the moon behaves as a uniformly rough scatterer, giving echoes out to 1 lunar radius or the limit of visibility of the moon's surface from the earth. An empirical fit to the integrated range versus time display provides an angular scattering law for each infinitesimal area of the surface given by:

$$P(\phi) \propto [(\sin\theta)/\theta]^{20\pm6} + 1/10$$

A procedure for mapping the details of the moon's surface by radar, using range and Doppler shift coordinates is suggested. This technique does not require angular resolution. *Subject Headings:* **1. Radar echoes from moon 2. Moon's surface. I. Presnell, R. I. II. Schlobohm, J. C.**—*Authors' abstract.* Ⓢ

11L–126 523.164.83:621.396

Lengrüsser, Peter, **Der Mond als Reflektor für Radiowellen.** [The moon as a reflector for radio waves.] *Weltraumfahrt*, Frankfurt a.M., 10(3):83–86, Sept. **1959.** 7 figs. **DLC**—The first experiment to use the moon as a reflector of radio waves was carried out at Belmar, N. Y., in 1948. The methods used and the data obtained are briefly presented. A later experiment took place in 1958, with the sending station at Belmar and the receiving at Bonn, W. Germany. The important feature of the new observation was the continuous radio signaling during several hours instead of sending impulses. The construction of both stations, a series of observations and the results are treated in detail. The experiment aimed to solve problems in different fields as: radio, television, radionavigation and radio-guidance (rockets). To fulfill this task further experiments will be conducted in the future. *Subject Heading:* **1. Lunar radio reflections.**—*E.K.* Ⓢ

THE MOON

See also: **Visual stellar magnitude of Moon** (Martinov), 11L–48; **Tidal acceleration due to Moon** (Longman), 11L–63; **Lunar radio emissions** (Zelinskaia et al.), 11L–103; **Lunar and planetary echo theory** (Brown), 11L–122; **Lunar echoes,** 11L–124 to 11L–126; **Antiradiant of meteor stream** (Makovetskiĭ), 11L–188.

11L–127 523.33

Fridliand, M. V., **K voprosu ob opredelenii svobodnoĭ libratsii Luny v dolgote.** [Determination of the moon's free libration in longitude.] *Akademiia Nauk SSSR. Institut Teoreticheskoĭ*

Astronomii, Biulleten', 7(4):293–317, **1959.** 5 figs., 10 tables, 21 refs., 39 eqs. English summary p. 293. **DLC**—An attempt is made to determine the constants of the Moon's libration including the constants of the free libration. Two series of observations by HARTWIG and NEFEDIEV separated by a great lapse of time are considered together. The free libration's amplitude, found to be 48″, is not smaller than the amplitude of the principal forced libration waves, and therefore it is impossible to neglect it when computing the constants of the Moon's libration. *Subject Heading:* **1. Moon's libration.**—*Author's abstract.* Ⓢ

11L–128 523.33

Iakovkin, A. A., **Dvizhenie Luny.** [The motion of the Moon.] *Priroda*, Moscow, No. 3:47–50, March **1960.** 3 figs. **DLC**—The author, one of the oldest astronomers of the U.S.S.R., explains the peculiarities of the Moon's motion around the Earth. He discusses the problem of two bodies in relation to the system Moon-earth, the influence of the sun, the accuracy of Brown's tables, and the rotation of the Moon around its axis. *Subject Headings:* **1. Moon's revolution 2. Orbit computation.**—*A.M.P.* Ⓢ

11L–129 523.34:535.243

Barabashov, N. P.; Ezerskiĭ, V. I. and Fedorets, V. A. (*all, Kharkov Astron. Obs.*), **Color contrasts of the lunar surface.** *Soviet Astronomy AJ*, New York, 3(3):484–489, Dec. **1959.** 8 figs., 4 tables, 10 refs. **DLC.** Transl. of **O tsvetovykh kontrastakh lunnoĭ poverkhnosti,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(3):496 502, May/June **1959. DLC**—The photographic spectrophotometric method has been employed for investigating the spectral reflecting properties of details of the lunar surface. The color contrasts in the usual system of color indexes are 0^m2 –0^m3. In the majority of cases, the relation between ΔCI and $\Delta \log I_{550}$ is close to linear, $(\Delta CI/\Delta \log I_{550})$ being ≈ 0.6. *Subject Headings:* **1. Moon's surface 2. Color of moon 3. Albedo of moon.**—*Authors' abstract.* Ⓢ

11L–130 535.243:523.34

Lipskiĭ, Iu. N., **Distinctive features of the spectrophotometric studies of the lunar surface.** *Soviet Astronomy AJ*, New York, 3(2):315–319, March/April **1959.** 3 figs., 5 refs., 8 eqs. **DLC.** Transl. of **Osobennosti spektrofotometricheskikh issledovaniĭ lunnoĭ poverkhnosti,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(2):322–326, March/April **1959. DLC**—A small area of the lunar surface can be considered as a source of light characterized by an intensity j, a degree of polarization p, and a position angle of the polarization plane φ. The intensity of the light resulting from n sources will be $J=\sum_{k=1}^{n} j_k$, the degree of polarization $P=\sum_{k=1}^{n} j_k p_k \cos 2\varphi_k / \cos 2\gamma \sum_{k=1}^{n} j_k$ and the position angle of the polarization plane γ will be given by $\operatorname{tg} 2\gamma = \sum_{k=1}^{n} j_k p_k \sin 2\varphi_k / \sum_{k=1}^{n} j_k p_k \times \cos 2\varphi_k$. Expressions have been found for the case when p and φ vary with wavelength along the spectrum. The spectrophotometric comparison of two areas of the lunar surface with J_1, p_1, φ_1 and J_2, p_2, S will give $J_1°$ and $J_2°$, respectively, at the outlet of the spectrograph. $J_1° : J_2° = \mu J_1 : J_2$; $\mu = (1+\beta_{11}) + (1-\beta_{11}) p_1 \cos 2\gamma_1 / (1+\beta_{11}) + (1-\beta_{11}) p_2 \cos 2\gamma_2$, where β_{11} is the polarization characteristic of the spectrograph. It is necessary to take the coefficient μ into account if spectrograms from sources with different p and φ are to be compared. A procedure which allows $J=J(\lambda)$, $P=P(\lambda)$, and $\varphi=\varphi(\lambda)$ to be determined free from instrumental distortion is described. *Subject Headings:* **1. Spectrophotometric observations 2. Moon's surface.**—*Author's abstract.* Ⓢ

11L–131 535.24:523.34

Teifel', V. G. (*Acad. Sci., Kazakh S.S.R.*), **On normal color indexes and the color-brightness relation for portions of the lunar surface.** *Soviet Astronomy AJ*, New York, 3(1):115–121, Jan./Feb. **1959.** 8 figs., 3 tables, 8 refs. **DLC.** Transl. **O normal'nykh pokazateliakh tsveta i zavisimosti tsvet-iarkost' uchastkov lunnoĭ poverkhnosti,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(1):114–120, Jan./Feb. **1959. DLC**—A catalog of normal color indexes of 262 small portions of the lunar surface, was compiled from photometric measurements of spectrograms of lunar regions in two wavelengths. On the basis of the catalog data, the upper limit of color contrasts on the lunar surface in a system of normal color indexes may be judged. The color indexes lie in the limits of $+0^m76$ to $+0^m97$, if the color index of the reference star α Aurigae is taken to equal $+0^m82$. The mean color index for all lunar objects investigated equals $+0^m85$. The existence is confirmed of a relation between the color and brightness of details on the lunar surface, which is expressed in the first approximation as a linear relation. *Subject Headings:* **1. Photometric observation techniques 2. Color of moon 3. Moon's surface.**—*Author's abstract.* Ⓢ

11L–132 523.346

Kopal, Zdeněk (*Dept. Astron., Univ. Manchester*), **Origin of the lunar craters and maria.** *Nature*, London, 183(4655):169–170, Jan. 17, **1959.** 6 refs. **DLC**—A reappraisal of the impact theory of the origin of the principal surface features of the moon is given. The author's discussion is based on the basic principles of BALDWIN'S evaluation of the kinetic energies necessary to cause moonquakes. A description of how these energies are converted into seismic waves is presented. The author discusses the different types of such waves, relative to the lunar circumference, 10921 km, and the effects any collision of solid bodies, such as comets or meteorites, with the moon would have on the latter. *Subject Headings:* **1. Moon's surface 2. Seismic waves on moon.**—*N.N.* Ⓢ

11L–133 523.346

Schmeidler, Felix (*Sternwarte, Munich Univ.*), **Die Entstehung der Mondkrater.** [Formation of the lunar craters.] *Naturwissenschaftliche Rundschau*, Stuttgart, 13(6):207–209, June **1960.** 2 figs. **DLC**—Based on the knowledge of the physical conditions of the moon, the various arguments for the meteoric or pluto-volcanic origin of its craters are surveyed and appraised, leaving the dispute of both theories an open question. Pictures of the moon at 11–12th day after new moon and of the Theophilus crater area serve as elucidation of the discussion. *Subject Heading:* **1. Moon's surface.**—*O.T.* Ⓢ

11L–134 523.346

Poppendiek, H. F. and Bond, W. H. (*both, Convair, San Diego*), **Recent observations of possible volcanic activity within the lunar crater Alphonsus.** *Astronomical Society of the Pacific, San Francisco, Publications*, 71(420):233–235, June **1959.** plate, 2 refs. **Comment** by Walter H. Haas (*Las Cruces, N. M.*). *Ibid.*, p. 236. 2 refs. **DLC**—An interesting paper reporting possible volcanic activity within the lunar crater Alphonsus. The observations were made on the evening of Nov. 18, 1958. It was observed that a large diffuse cloud completely obscured the crater's central mountain peak and its small craterlet. This cloud was about 20 mi in diameter and irregular in shape. Its general appearance is shown in a drawing. WALTER H. HAAS in his comment on this paper states that his own observations do not corroborate the reported observations. *Subject Headings:* **1. Moon's surface 2. Volcanic eruptions on moon.**—*I.S.* Ⓢ

11L–135 551.510.53:523.35:523.51

Sytinskaia, N. N. (*Astron. Obs., Acad. Sci., U.S.S.R.*), **New data on the meteoric-slag theory of the formation of the outer layer of the lunar surface.** *Soviet Astronomy AJ*, New York, 3(2):310–314, March/April **1959.** table, 18 refs. **DLC.** Transl. of **Novye materialy po meteorno-shlakovoĭ teorii obrazovaniia naruzhnogo pokrova lunnoĭ poverkhnosti,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(2):315–321, March/April **1959. DLC**—The results of photometric, colorimetric and polarimetric investigations of the moon, as well as data on the thermal conductivity of the outer layer, have led the author to the conclusion that everywhere the visible lunar surface is composed of highly porous ragged material, the structure of which resembles volcanic slag. It originated from the rocks of the lunar crust under the influence of explosions, accompanying the collisions of meteors with the lunar surface. New facts are given which confirm this "meteoric-slag" theory of the origin of the outer layer of the lunar surface. Recent determinations give such low values for the possible density of the lunar atmosphere, that even micrometeorites should reach the lunar surface with cosmic velocities. Rocket investigations give a frequency of encounters with micrometeorites equal to one impact per cm^2 per minute. Therefore, the action of micrometeorites alone is sufficient for the formation on the lunar surface of a continuous film of modified material during a very short time. The resulting slag material is of a dark color due to the decomposition of silicates of the type of olivine and the formation of black iron oxides of the type FeO, Fe_2O_3 and Fe_3O_4. It is darker on the lunar maria than on the "continents" because the original rocks of the former contain a higher proportion of iron. *Subject Headings:* **1. Moon's surface 2. Micrometeorites.**—*Author's abstract.* Ⓢ

11L–136 523.39

von Bülow, Kurd, **Gesichtspunkte zur Beurteilung der ersten Photos von der Rückseite des Mondes.** [Views on the evaluation of the first photographs of the back side of the moon.] *Beiträge zur Geophysik*, Leipzig, 69(3):129–139, **1960.** 3 figs., 13 refs. German, French and English summaries p. 129. **DWB, DLC**—Although the first photos of the back side of the Moon are ambiguous due to lack of detail, vertical illumination, and relatively small scale, certain statements may be made nevertheless: unknown elements are not found, true "seas" exist certainly, epicontinental "seas" probably; craters seem to be very numerous, indications for meridional tectonics (i.e. from north to south) are perceptible. The mare belt of the front side seems to continue in that part of the back side caught by the photos. Between the front and the back sides of the Moon there is a difference in scale rather than in basic characteristics. *Subject Headings:* **1. Moon's surface 2. Far side of moon 3. Lunar photographs.**—*Author's abstract.* Ⓢ

PLANETS

See also: **Life in the universe** (Huang), 11L–9; **Existence of life in the universe** (Vale), 11L–10; **Radio emissions from Jupiter** (Roberts, Stanley), 11L 104; **Radio echoes from Venus** (Evans, Taylor), 11L 121; **Lunar and planetary echo theory** (Brown), 11L–122; **Planetary fragmentation** (Perdrix), 11L–158.

11L–137 523.4

Singh, R. P. and Goel, N. S., (*both, Indian Inst. of Technology, Bombay*), **The physical state of condensed matter and the radius of a cold planetary body.** *Zeitschrift für Astrophysik*, Berlin, 50(4):269–277, **1960.** fig., table, 16 refs., 18 eqs. **DLC**—The physical state of matter on a cold planetary body has been investigated in the light of Bohm-Pines' theory of plasma oscillations in metals. It has been shown that the radius of a planet depends on the degree of ionization of the condensed matter. The logarithms of the calculated radii of various planets are plotted against the logarithm of the mass of the planet expressed as a fraction of solar mass. A comparison of the calculated and observed radii gives an idea of the mean molecular weight or the degree of ionization and hence also of the internal composition. *Subject Heading:* **1. Planetary mass.**—*Authors' abstract.* Ⓢ

11L–138 521.5

Callaghan, Francis P., Jr. (*General Atronics Corp., Bala-Cynwyd, Pa.*), **Planetary orbit chart.** *Journal of Applied Physics*, N. Y., 30(3):444–445, March **1959.** fig., ref. 13 eqs. **DLC**—If proper normalization of units is performed, the twofold infinity of orbits can be reduced to a single infinity, and thus represented on a single chart. The whole orbit can be plotted easily from given initial data, and the velocity at each point of the orbit also obtained. The chart and computational procedure are given in detail Height of apocenter and pericenter can be obtained directly from the chart without plotting the whole orbit. *Subject Headings:* **1. Planetary orbits 2. Orbit computation.**—*E.Z.S.* Ⓢ

11L–139 523.45/6:521.312

Clemence, G. M. (*U. S. Naval Obs., Wash., D. C.*), **Motion of Jupiter and mass of Saturn.** *Astronomical Journal*, New Haven, Conn., 65(1):21–22, Feb. **1960.** 2 figs., 8 refs. **DLC**—The discrepancy between theory and observation in the longitude of Jupiter found by Krotkov and Dicke, which has a coefficient of 0″.25 and a period of 4520 days, is removed by attributing mass 1/3499.7 to Saturn and adding two known corrections to the motion of the perihelion. *Subject Headings:* **1. Jupiter 2. Saturn 3. Planetary mass.**—*Author's abstract.* Ⓢ

11L 140 521.312:521.5

Garfinkel, Boris (*Aberdeen Proving Ground, Md.*), **The orbit of a satellite of an oblate planet.** *Astronomical Journal*, New Haven, Conn., 64(9):353–367, Nov. **1959.** 7 refs., 114 eqs. **DLC**—The paper gives a solution of the problem of motion of a particle in the potential field $V = -I/r + 2kP_2(\sin\theta)/r^3 + k'P_4(\sin\theta)/r^5$, where k and k' are small parameters. The first approximation is furnished by a V_0 that incorporates a major portion of the second spherical harmonic and leads to a closed solution with no secular variations of order k. The perturbations of this non-Keplerian intermediary orbit are derived here by the von Zeipel modification of the method of Delaunay. The secular variations are carried up to orders k^2 and k', and the periodic variations to orders k and k'/k. A computational summary is included; the effect of the third spherical harmonic is appended. *Subject Headings:* **1. Satellite orbits 2. Orbit computation.**—*Author's abstract.* Ⓢ

11L–141 523.46

Grebenikov, E. A., **The perturbed motion of Saturn's eighth satellite Iapetus.** *Soviet Astronomy AJ*, New York, 3(2):353 361, March/April **1959.** 9 tables, 4 refs., numerous eqs. **DLC.** Transl. of **Vozmushchennoe dvizhenie vos'mogo sputnika Saturna Iapeta,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(2):361–369, March/April **1959. DLC**—Computed absolute perturbations of Saturn's eighth satellite Iapetus obtained by Hill's method are given. Perturbations due to the form of Saturn, the sun and the satellite Titan have been found. Tables 8 and 9 in 7 give a comparison between the calculated elements and coordinates and those found by other authors. *Subject Headings:* **1. Saturn 2. Satellite orbits.**—*Author's abstract.* Ⓢ

METEORS

GENERAL

11L–142 523.5:522.1

Millman, Peter M. (*Natl. Res. Council, Ottawa*), **The Meanook-Newbrook meteor observatories.** *Royal Astronomical Society of Canada, Journal*, 53(1):15–33, Feb. **1959.** 11 figs., table, 11 refs.

DLC—This is a description of the establishment and facilities of the Meanook-Newbrook meteor observatories. The design and construction of the meteor cameras, their delivery and erection at the sites are explained and illustrated. The Meanook-Newbrook meteor observatories are operated as field stations of the Stellar Physics Division of the Dominion Observatory in Ottawa. It contains brief notes on the weather conditions and the observing program. *Subject Headings:* **1. Meteor observatories 2. Canada.**—*E.Z.S.* Ⓢ

11L–143 523.5

Millman, Peter M. (*Natl. Res. Council, Ottawa*), **The I.G.Y. visual meteor programme—Progress Report No. 3.** *Royal Astronomical Society of Canada, Journal,* 53(3):137–141, June **1959.** table, 3 refs. **DLC**—This is the third progress report of the IGY visual meteor program (Ottawa). The first two reports and also two Bulletins have listed a total of 33,882 meteors reported up to April 15, 1958. In this report an additional 44,216 meteors are included. The records of these new observations were received at headquarters between April 15 and Oct. 15, 1958. These observations are now being transferred to IBM punched cards for statistical study in collaboration between the Dominion Observatory and the National Research Council. *Subject Heading:* **1. Meteor observations.**—*E.Z.S.* Ⓢ

11L–144 523.5

Millman, Peter M. (*Natl. Res. Council, Ottawa*), **The I.G.Y. visual meteor programme—Progress Report No. 4.** *Royal Astronomical Society of Canada, Journal,* 54(1):39–41, Feb. **1960.** 2 tables. **DLC**—This is the fourth tabulation of observations contributed by volunteers working on the special IGY program of visual meteor observation. It completes the listing of all visual meteor observations made prior to the termination of the official 20 month IGY period. A summary of the total number of meteors reported for the entire IGY period is given. *Subject Headings:* **1. IGY meteor program 2. Meteor observations.**—*E.Z.S.*— Ⓢ

11L–145 523.5:523.7(477.9)

Torshenko, S. I., **Meteor v luchakh Solntsa.** [A meteor in solar rays.] *Priroda,* Moscow, No. 3:110–111, March **1960. DLC**—A meteor flight in the rays of the rising sun was observed in Sevastopol on Aug. 13, 1959 at 0540 o'clock, 20 minutes before sunrise. The meteor which flew in the direction of Betelgeuse, 1. Σ from west to east appeared in the constellation of Cassiopeia. The slope angle to the horizon of the flight trajectory was about 70°. The flight was observed for 3–4 seconds. It left a uniform, very bright silvery and rapidly twinkling light with a brightness of 1 stellar magnitude. *Subject Headings:* **1. Meteors 2. Sunrise 3. Sevastopol, Ukrainian S.S.R.** —*I.L.D.* Ⓢ

FIREBALLS

11L–146 523.51(584.8)

Karimov, M. G. and Matiagin, V. S., **Iarkiĭ bolid 25 dekabria 1957 g.** [Bright bolide of Dec. 25, 1957.] *Meteoritika,* Moscow, Vol. 17:9–22, **1959.** 2 tables, ref., eqs. **DLC**—The bolide of Dec. 25, 1957 was witnessed by many individuals in southern Kazakhstan and in western Kirgizia. The bolide appeared in the form of a bright sphere with conical fire tail over an area extending more than 700 km in a direction perpendicular to the flight. It was part of a meteorite shower that fell in the mountains of Dzhalal Abad region of the Kirgiz, SSR. In this article the author presents the history of the inquiry carried out in order to determine the course and characteristics of the meteorite, and the reports of eyewitness accounts; the data of eyewitnesses on the time of flight; the determination of the position of the point of extraction on the basis of the heart square method and the determination of the radiant. *Subject Headings:* **1. Bolides 2. Dzhalal-Abad region 3. Kirgiz S.S.R.** —*I.L.D.* Ⓢ

11L–147 523.51:521.75 551.590.25

Oliver, Charles P. (*Flower & Cook Observ. U. Pa. Phil.*), **The great fireball of July 26, 1938.** *Science,* Wash., D. C., 131(3393):86–88, Jan. 8, **1960.** table. **DLC**—The solution of paths and orbits of a fireball that had a hyperbolic velocity through the explosions over eastern Penna. to the west of N. Y. City is described. It has also computed a parabolic orbit in relation to atmospheric path, altitudes and azimuths, color and its stellar magnitude, and train in the 104 to 80 km level with a map of the region and the unit of 1 mm to 1 min. of latitude. The method of calculation on the path through atmosphere was explained regarding vertical and horizontal path, height, and diagram on which to determine the observed velocity and duration. The sub-beginning point (B_1), the sub-end point (E_1), and an intermediate point (C_1) were chosen as the unit for the chart with the slope of the true path. The result of calculation with four-place logarithms to minutes of arc is shown in a Table. *Subject Heading:* **1. Fireball data.**—*K.C.* Ⓢ

METEORITES

See also: **Origin of lunar craters** (Kopal), 11L–132; **Formation of lunar craters** (Schmeidler), 11K–133; **Meteoric-slag theory of lunar surface** (Sytinskaia), 11L–135.

11L–148 523.51:546.683

†Anders, Edward (*Univ. Chicago*) and Stevens Charles M. (*Argonne Nat'l Lab., Argonne, Ill.*), **Search for extinct lead 205 in meteorites.** *Journal of Geophysical Research*, Wash., D. C., 65(10): 3043–3047, Oct. **1960.** 3 tables, 21 refs., 2 eqs. **DLC**—The isotopic composition of thallium from six meteorites was measured, in order to determine whether any radiogenic Tl^{205} from the decay of 24-m.y. Pb^{205} was present. Although the Pb/Tl ratios of these meteorites differed by factors of 50, isotopic compositions of meteoritic and terrestrial thallium were equal to within 1 percent. For Canyon Diablo, this implies a solidification time of $\geq 3.0 \times 10^8$ years after nucleogenesis by the 'sudden synthesis' model, and $\geq 1.0 \times 10^8$ years after the isolation of the solar system by the 'continuous synthesis' model. The bearing of these results on the $I^{129}-Xe^{129}$ ages of Reynolds is discussed. *Subject Headings:* **1. Meteorite compostion 2. Thallium.**—*Authors' abstract.* Ⓢ

11L–149 523.51

Anfimov, N. A. (*Moscow Physicotechnical Inst.*), **Some regularities in the motion of meteoric bodies in the atmosphere.** *Soviet Astronomy AJ*, New York, 3(1):139–142, Jan./Feb. **1959.** 2 figs., 8 refs., numerous eqs. **DLC.** Transl. of **Nekotorye zakonomernosti dvizheniia meteornykh tel v atmosfere,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(1):137–140, Jan./Feb. **1959. DLC**—Analysis is made of the relation between dimensionless quantities in the study of the process of heat transfer in meteor-air encounters. An empirical formula is derived for the coefficient $\sigma = A/2\Gamma\zeta$. A number of conclusions are arrived at on the relation between melting and evaporation in the ablation of meteoric bodies. *Subject Heading:* **1. Meteor ablation.**—*Author's abstract.* Ⓢ

11L–150 551.541:523.51:551.596.1

Fesenkov, V. G., **O vozdushnoĭ volne, proizvedennoĭ padeniem Tungusskogo meteorita 1908 g.** [Air wave caused by the fall of the Tunguska meteorite in 1908.] *Meteoritika*, Moscow, Vol. 17:3–7, **1959.** fig., 4 refs., eqs. **DLC**—The barogram obtained by the Potsdam Geophysical Institute during the fall of the Tunguska meteorite in 1908 is a unique example of the direct and reverse pressure obtained at the same observatory with the same apparatus. The equation relating velocity (v) of sound and height of passage of wave in the atmosphere (h) is derived, namely: $2\pi(R+h)\,[1-(S°/120°)] = (t_2-t_1)v$ where $S°$ = angular distance between Potsdam Geophysical Institute and location of explosion of the Tunguska meteorite. It is shown that the fundamental disturbance was propagated around the earth at a height of 5.3 km and that the most diverse stations received secondary impulses from this layer of relatively slight thickness. The explosion in the atmosphere was practically a plane wave and the dimension of the pulsating mass can be compared with the distance traversed by the sound during a semiperiod of oscillation, namely 23 km. Also the law of variation of the amplitude of the wave of disturbance with distance and the line of explosion are determined. *Subject Headings:* **1. Atmospheric waves 2. Meteorite effects.**—*I.L.D.* Ⓢ

11L–151 551.521.64:523.51:546.293

Fireman, E. L. and DeFelice, J. (*both, Smithsonian Astrophys. Obs., Cambridge, Mass.*), **Argon 37, argon 39, and tritium in meteorites and the spatial constancy of cosmic rays.** *Journal of Geophysical Research*, Wash., D. C., 65(10):3035–3041, Oct. **1960.** 3 figs., table, 5 refs. **DLC**—The radioactive isotopes argon 37, argon 39, and tritium are measured in the Hamlet chondritic meteorite and in the Aroos iron meteorite. The ratio of the radioactivity of argon 37 to that of argon 39 at the time of fall is 2.3 ± 0.2 for the Hamlet meteorite and 1.4 ± 0.3 for the Aroos meteorite. The ratio of the production rate of argon 37 to that of argon 39 in a sample of the Hamlet meteorite irradiated with 2-bev protons is 1.2 ± 0.3. These measurements indicate a higher flux of cosmic rays at a distance of 1 astronomical unit from the sun than at several astronomical units. The ratio of the radioactivity of tritium to that of argon 39 is 29 ± 6 for the Hamlet meteorite and 2.0 ± 0.5 for the Aroos meteorite. The ratio of the production rates in the Hamlet target sample is 24 ± 6. The ratio of tritium to argon 39 in the Benton chondritic meteorite is 29 ± 4. The data indicate that the cosmic-ray flux integrated over the same region of space for different times is constant. The tritium is anomalously low in the Aroos iron meteorite. Similar tritium anomalies have been observed previously in iron meteorites. *Subject Headings:* **1. Cosmic ray flux 2. Meteorite composition 3. Argon 4. Cosmic ray effects on meteorites.**—*Authors' abstract.* Ⓢ

11L–152 523.51:551.521.64

Gerling, E. K. and Levskii, L. K., **Kosmicheskiĭ vozrast Sikhote-Alinskogo meteorita.** [The cosmic age of the Sikhote Alin meteorite.] *Akademiia Nauk SSSR, Doklady*, 130(1):45–46, **1960.**

table, 4 refs., eq. **DWB, DLC**—The authors investigated the content of radioactive isotopes H^3 and A^{39} in the Sikhote Alin meteorite. The procedure for measuring low tritium (H^3) activities and the number of disintegrating A^{39} nuclei is described and the results of measurements of radioactivities of H^3 and A^{39} are presented in a table. From the amount of He^3 obtained as a result of disintegration of tritium and the rate of disintegration of tritium (i.e., rate of formation after establishment of equilibrium) the cosmic age of the meteorite is deduced as $(900 \pm 200) \times 10^6$ years. From the rate of disintegration of A^{39} the cosmic age is computed as $(430 \pm 50) \times 10^6$ years. The time of radiation renders it possible to estimate from the amount of A^{39} the number N of cosmic particles intersecting 1 cm² per second; $N = 2n_1/\sigma_A{}^{38} n_2 T$ where n_1 = number of A^{38} atoms in 1 g, n_2 = number of iron atoms in 1 g, $\sigma_A{}^{38}$ = mean cross-section of the structure A^{38}; $N \cong 2.3$ part./cm² sec. *Subject Headings:* **1. Cosmic ray effects on meteorites 2. Age of meteorites.**—*I.L.D.* Ⓢ

11L–153 523.51

Hawkins, Gerald S. (*Boston Univ. and Harvard College Obs., Cambridge, Mass.*), **Asteroidal fragments.** *Astronomical Journal*, New Haven, Conn., 65(5):318–322, June **1960.** 5 figs., table, 11 refs., 18 eqs. **DLC**—The meteorite catalogue of PRIOR and HEY was used to determine the rate of fall and mass distribution of meteorites. An analysis for the United States and Europe shows that 3.3 meteorites with a mass ≥ 10 kg reach the earth per day. The cumulative number with mass greater than or equal to a chosen value m varies as $1/m$. This law holds for stone finds and falls and iron falls. The iron finds include an excess of larger objects, attributed to selection effects on the ground. If this influx has been constant, the earth has collected the equivalent of an asteroid 14 km in diameter during the last 5×10^9 years. It is estimated that the asteroids consist of 16.7% by weight of nickel-iron, indicating a primary object that before breakup was intermediate in size between the moon and Mars. The space density of meteorites is shown to vary as $(\text{radius})^{-4}$ and the total mass of meteorites with radius between 1 cm and 1 km is at least 5.6×10^{-24} g cm^{-3}. The size distribution of particles produced by the crushing of rock is similar to that found for meteorites and suggests that meteorites undergo a considerable number of collisions in space. *Subject Heading:* **1. Meteorites.**—*Author's abstract.* Ⓢ

11L–154 523.51:538.6

Iavnel', A. A., **Meteoritnoe veshchestvo na meste padeniia Tungusskogo meteorita.** [Meteoritic matter at the site of the fall of the Tunguska meteorite.] *Meteoritika*, Moscow, Vol. 17:8, **1959 DLC**—The results of analysis of soil samples taken during 1927–1930 by L. A. KULIK in the region where the Tunguska meteor fell are presented. In the magnetic fraction, samples of silvery white shavings contained iron with admixtures of 7% Ni, 0.7% Co, 0.01% Ge, and the typical composition of meteoritic iron, according to spectrographic analysis. Also 109 spheres about 30–50 m in diameter and chiefly of magnetic constitution were found. It is assumed that the particles of meteoritic dust are residues of the Tunguska meteor formed during the explosion and disintegration of its material. This meteorite was primarily composed of iron and the presence of the magnetic spheres indicates that they were formed during the movement of the meteorite in the Earth's atmosphere. *Subject Heading:* **1. Meteorite structure.**—*I.L.D.* Ⓢ

11L–155 523.51(781)

Krinov, E. L., **Kamennyĭ meteoritnyĭ dozhd' Norton-Kaunti, SSHA.** [Meteoritic showers of Norton County in the U. S.] *Meteoritika*, Moscow, Vol. 17:80–84, **1959.** 4 figs., 2 tables. **DLC**—On the basis of the articles of LINCOLN LA PAZ, **The achondritic shower of Feb. 18, 1948** (*Astronomical Society of the Pacific, Publications*, 6, April 1, **1949**) and of C. W. BECK and L. LA PAZ, **The Nortonite fall and its mineralogy** (*American Mineralogist*, 36:45–49, **1951**) the author discusses the stone meteorite shower of Feb. 18, 1948 in Norton County, Kansas. This meteorite shower was the largest, both in respect to mass and individual specimens of stone meteorites. It was observed by many people so that the trajectory and orbit could be described. This shower belongs to the rare type known as achondrites. The meteorite shower was accompanied in the sky by a large bolid followed by a cloud trail. The article contains an account of the expedition to the region where the meteorite shower occurred, a description of the area over which the shower fell and the results of an analysis of the chemical composition of the Norton County meteorite and of similar meteorites and of the chemical composition of the metallic phase of this meteorite. *Subject Headings:* **1. Meteoritic showers 2. Norton County, Kans.**—*I.L.D.* Ⓢ

11L–156 523.51

†Levin, B. Iu., **O proiskhozhdenii meteoritov.** [Origin of meteorites.] *Meteoritika*, Moscow, Vol. 17:55–63, **1959.** 22 refs. **DLC**—The theory and evidence that associate the origin of meteorites with the evolution of intermediate asteroids, HAROLD UREY'S hypothesis on the existence of numerous "primary bodies" instead of a single planet and the process of formation of these bodies out of their chondrules, the accumulation of chondrules into relatively large bodies are reviewed.

The difficulties associated with the formation of "primary bodies" and the subsequent formation of chondrules from these bodies in the protoplanetary clouds as a result of condensation by taking into account the experimental data of V. A. KARGINA and Z. IA. BEZSTOVA in the formation of colloidal particles from diluted solutions are discussed. Accordingly the amorphous structure of primary particles and their spherical shape is explained by the fact that their formation occurred under conditions when the union of molecules or ions was equally probable from all sides at temperatures much lower than their fusion temperatures, since their reconstitution did not proceed in the order corresponding to crystal lattices. These facts remain there for the formation of solid phases from a gas, as in a protoplanetary cloud. Under conditions of low temperature and extremely rarefied gases condensation may be very slow and may produce a large dispersion of dimensions of the particles being formed. The formation of chondrules from a cold gas encounters the difficulty that at low temperature condensation would be slightly selective and not capable of explaining the mineral composition of chondrules and the formation of iron meteorites. In the case of high temperatures which decrease gradually there is a fractionation of condensation and chondrules formation would be similar to that of rain or hail particles. The chondrules and also metallic and troilite particles entered into the composition of a condensed desk of dust substances being accumulated in the central plane of a protoplanetary cloud and hence entered into the composition of bodies of asteroidal or lunary dimensions being formed from this disk. These bodies possess the structure of chondrules, since their further evolution associated with radioactive heating and also with their disintegration and the function of new bodies from fragments explains the existence of unaltered and recrystallized chondrules, Creccia meteorites. *Subject Heading:* **1. Meteorite origin.**—*I.L.D.*

11L 157 523.51

Lovering, J. F. (*Dept. of Geophys., Australian Natl. Univ., Canberra*), **Frequency of meteorite falls throughout the ages.** *Nature*, London, 183(4676):1664–1665, June 13, **1959. DWB, DLC**—Evidence that iron and stone meteorites have fallen throughout the ages is submitted. Cosmic spherules that date back to the Tertiary times have been found in the deepest sections of the cores of sediments from the Pacific Ocean. Several authors have described the usual occurrence of the Sardis coarse octahedrite buried in the Miocene Sea. Iron meteorite was found at a subsurface depth of 1525 ft in an oil well drilled in Zapata County, Tex. Recent determinations of cosmic ray ages of certain meteorites indicate that they were broken from their parent bodies about 10^9 yrs ago. *Subject Headings:* **1. Meteorite frequencies 2. Age of meteorites.**—*N.N.* Ⓢ

11L–158 523.51

Perdrix, J. L., **Planetary fragmentation.** *Astronomical Society of Victoria* [*Australia*], *Journal*, 12(2):23–26, April **1959. DLC**—This paper discusses the mechanism by which planetary fragmentation took place. The term fragmentation implies that meteorites have come from the interior of a larger body. The three possible mechanisms which could account for the parent planets break up are: 1) tidal disruption 2) explosion 3) collision. It is concluded that meteors and meteorites have most likely resulted from the collisions between small planets and that these collisions occurred in the inner portions of the solar system. *Subject Headings:* **1. Meteorite origin 2. Planetary fragmentation.**—*I.S.* Ⓢ

11L–159 551.521.64:550.9:523.51

Voshage, H. and Hintenberger, H. (*both, Max-Planck-Institut, Mainz*), **Calculation of cosmic-ray ages in the iron meteorites "Carbo" and "Treysa."** *Nature*, London, 185(4706):88–89, Jan. 9, **1960.** 4 refs., 3 eqs. **Comment** by R. R. Marshall. **DWB**—The authors obtained the following limits for the radiation ages of the iron meteorites Carbo Tc = (1.05 . . . 1.40) $\times 10^9$ yrs and Treysa Tt = (0.50 . . . 0.67) $\times 10^9$ yrs. The rather wide range for the difference depends upon the scattering of experimental results and on the possibility that the absolute radiation age of Carbo may have any value between several times 10^8 and 4.5×10^9 yrs as long as no special assumptions are made regarding the production cross-sections. *Subject Headings:* **1. Cosmic ray effects on meteorites 2. Age of meteorites.**—*E.Z.S.* Ⓢ

11L–160 523.51(791)

Walton, Matt (*Yale Univ., New Haven, Conn.*), **The Arizona meteor crater controversy.** *Royal Astronomical Society of Canada, Journal*, 53(4):162–171, Aug. **1959.** 15 refs. **DLC**—A review and brief analysis of some assumptions concerning estimates of the mass of the meteor, and the possibility of a buried mass beneath the Arizona Crater. It is pointed out that until the presence of a certain amount of unvaporized, even relatively unheated, meteorite fragments in addition to the residue of condensed vapor can be adequately accounted for by a detailed theory, the problem of the Arizona meteor crater cannot be regarded as completely solved. One of the conclusions that emerges is that absence of residual meteorite fragments in the vicinity of a crater is no argument against its origin by meteorite impact. Large meteorites are apt to be totally vaporized if they strike as a single compact mass. If the meteorite were of stony rather than metallic composition, the silicate con-

densation products would probably not survive weathering very long and would be difficult to recognize or collect in the soil. *Subject Headings:* **1. Meteorite craters 2. Arizona.**—*E.Z.S.* Ⓢ

METEORIC DUST

See also: **The nature of zodiacal light** (Fesenkov), 11L 202; **The nature of counterglow** (Fesenkov), 11L–203; **Conditions of disintegration of asteroids** (Fesenkov), 11L–204.

11L–161 523.51(47)

Bgatov, V. I. and Cherniaev, Iu. V., **Meteornaia pyl' v shlikhovykh probakh.** [Meteoric dust in slick samples.] *Priroda*, Moscow, 7:111–112, July **1959.** 2 figs., 2 refs. **DLC**—A mineralogical analysis of slick samples from the western part of the Suchanskii coal basin showed the presence of mineral particles of regular shape mainly in the magnetic fraction. According to their morphological, physical and chemical properties these particles are completely identical with meteoric dust found in the regions where Sikhote Alin and the Tunguska meteorites had fallen. *Subject Headings:* **1. Meteoric dust 2. U.S.S.R.**—*A.M.P.* Ⓢ

11L–162 523.51

Pettersson, Hans, **Cosmic spherules and meteoritic dust.** *Scientific American*, N. Y., 202(2): 123–132, Feb. **1960.** 7 figs. **DWB, DLC**—Cosmic spherules and meteoritic dust are released at a rate of a million tons per year. Ocean sediments show evidence of their deposition. The article reports on a series of investigations and results obtained from studies of ocean cores. A list of several foreign countries and agencies that have financed these investigations is given. Samples also have shown immeasurable quantities of mineral deposits found either in rain water collected or in ocean water studied. Figures are in millions of tons per year. Most of the work reported on was done in Hawaii. *Subject Heading:* **1. Cosmic dust accretion.**—*N.N.* Ⓢ

11L–163 523.51

†Pettersson, Hans, **The accretion of cosmic matter to the earth.** *Endeavour*, London, 19(75):142–146, July **1960.** 6 figs. (incl. photos), 24 refs. **DLC**—Deep-sea samples taken on the Challenger expedition of 1872–76, and analyses of Arctic snow made at about the same time, demonstrated the accretion of cosmic matter to the Earth. Only comparatively recently, however, has it been possible to obtain sufficient samples, corresponding to geologically considerable periods of time, to estimate both the temporal and geographical variation of the fall of matter of cosmic origin. This article reviews the results of recent investigations of long deep-sea cores and of air samples taken at observatories remote from the contaminating effects of the artifacts of industrial activity. *Subject Heading:* **1. Cosmic dust accretion.**—*Author's abstract.* Ⓢ

METEORS AND ASTRONAUTICS

11L–164 551.507.362:551.596:523.51

Buck, Richard F., **Acoustic detection of meteoric particles.** Oklahoma. State Univ., Stillwater. Research Foundation, Contract AF 19(604)-1908, Final Report, April 14, **1960.** 148 p. 38 figs., 5 plates, tables. Note: Final Report contains Appendix A, **Computations for impact calibration.** Appendix B by Curtis W. McCracken, **Analysis of rocket and earth satellite measurements of micrometeoric influx** issued separately. (*See* next item 11L–165.) **DWB**—Contract AF 19(604)-1908, sponsored by the Air Force Cambridge Research Center, Air Research and Development Command, has resulted in an investigation concerned with the possible detection of the influx of micro-meteoritic material. The technique used for detection has been based upon acoustic activation of suitable devices by the impact of such meteoric material upon metallic surfaces carried by high altitude rockets. The development of this technique is traced from the early and somewhat accidental discovery that such a mechanism might exist through a definite program of rocket instrumentation designed to exploit this technique to a more sophisticated electronic system especially devised for installation in satellite and space probe vehicles, which are capable of much longer sampling time for the basic phenomenon under investigation. In the course of this investigation a number of related laboratory investigations have been required from time to time. These laboratory investigations have been concerned with two general aspects of the basic investigation: the establishment of a working technique and verification of the validity of information obtained through this technique, and in a more indirect approach, a secondary series of investigations performed in order to establish the suitability of the specific electronic devices developed for use in the technique. Specific details regarding rocket experimentation performed in connection with this contract are given for a number of rocket flights which occurred during the four year period of services under this contract, and an up-to-date tabulation of the data which were obtained from this series of rocket experiments is included. A discussion of the problems of interpretation of the information acquired from each

specific rocket experiment system accompanies the data. Appendix B to this report sets forth a possible analysis of the measurements of micro-meteoritic influx obtained in the course of this and other allied investigations. *Subject Headings:* **1. Acoustical detection of meteoric particles 2. Rocket instrumentation 3. Meteoric impact detectors.**—*Author's abstract.* Ⓢ

11L–165 551.507.362:523.51

†McCracken, Curtis W., **Analysis of rocket and earth satellite measurements of micrometeoric influx.** Oklahoma. State Univ., Stillwater. Research Foundation, Contract AF19 (604)-1908, Final Report, Vol. 2 [i.e. Appendix B to Final Report], April 14, **1960.** 120 p. 22 figs., 19 tables, 42 refs., eqs. **DWB**—The primary purpose of this paper is an attempt to attach a meaningful significance to recent measurements of micrometeoric influx, as determined by high-altitude rockets and Earth satellites. Other known data on meteoric influx are introduced to support the micrometeor data and to provide a framework onto which the micrometeor data can be added to the analysis. Some of the data on meteoric influx, as well as the recent data on micrometeoric influx, suggest a major change in the mass distribution function from the function in prevalent use at the present time. The micrometeor data and some of the other available data on meteoric influx are plotted together as particle influx versus particle momentum to get a tentatively revised mass distribution curve. An equation is fitted to the tentatively revised mass distribution curve in order to obtain the corresponding tentatively revised mass distribution function. The new mass distribution function allows a significant extension of the known mass distribution function for meteoric particles. Some of the implications of the tentatively revised mass distribution function are discussed in a quite qualitative manner. *Subject Headings:* **1. Meteor observation techniques 2. Satellite observation of meteors 3. Rocket observation of meteors.**—*Author's abstract.* Ⓢ

11L–166 551.507.362:523.51

Cohen, Herbert A., **Measurements of flux of small extraterrestrial particles.** *U. S. Air Force. Cambridge Research Center, GRD Research Notes*, No. 28, Jan. **1960.** 13 p. 2 figs., 3 tables, 10 refs., 2 eqs. **DWB**—Through use of wire grids and highly sensitive microphones, direct measurements of micrometeorite influx and damaging effects have been made from satellites and rockets. These measurements indicate that 10^{-3} particles/(m^2 sec) is the order of magnitude of flux into the Earth's atmosphere of extraterrestrial particles several microns in size; they also indicate shower periods. *Subject Headings:* **1. Rocket observation of meteors 2. Satellite observation of meteors 3. Micrometeorites.**—*Author's abstract.* Ⓢ

11L–167 523.51:523.16

Dubin, Maurice (*A. F. Cambridge Res. Center*), **Cosmic debris of interplanetary space.** *U. S. Air Force. Office of Scientific Research, Vistas in Astronautics: second annual Symposium, April 1958.* pub. N. Y. Pergamon Press, **1959.** p. 39–45. 3 figs., 7 refs. **DWB** (629.1388 U581as)—The environment of vehicles in the interplanetary space and in satellite orbits contains debris of asteroidal and cometary origin. Such particulate material moving at heliocentric velocities interacts at very high-energy densities upon collision with planetary atmospheres and space vehicles. Direct measurements of the dust component of this cosmic debris have been undertaken with rocket and satellite vehicles. These measurements involve the determination of the spatial density and size distribution of cosmic dust, as well as the impact damage to space vehicles. Various experimental techniques used on high-altitude vehicles are described; in particular the experimental equipment used on rockets and on the IGY satellite, Alpha 1958. Specifically, the method using the ultrasensitive, acoustical accelerometer has been developed and its operation over a large range of impact strengths and its area sensitivity are described. Some results from measurements made with such equipment are presented. The associated problem of abrasion damage from cratering is also discussed in relation to experiments using rocket-launched vehicles. Preliminary estimates of the distribution of cosmic dust may be made on the basis of the measurements to data, although additional measurements are warranted to obtain accurate environmental criteria concerning cosmic debris. *Subject Headings:* **1. Cosmic dust grains 2. Interplanetary matter 3. Satellite observation of meteors.**—*Author's abstract.* Ⓢ

RADIO METHODS APPLIED TO METEORS

See also: **Velocity of meteors of Geminid shower** (Dudnik et al.), 11L–192; **Radar observation of Perseids during 1957** (Fialko), 11L–193.

11L–168 551.510.535:551.594.12:523.5

Dokuchaev, V. P., **Elektricheskiĭ razriad pri prolete meteorov v atmosfere Zemli.** [Electrical discharge during the flight of meteors in the earth's atmosphere.] *Akademiia Nauk SSSR, Doklady,*

31(1):78–81, **1960.** 14 refs., 6 eqs. **DLC**—The observed electromagnetic phenomena accompanying the flight of meteors in the earth's atmosphere, such as long and medium radio wave emission from ionized meteor trails, the luminescent aureola around flying particles, etc. can be explained by an electric discharge in the gas arising during the flight of meteors in the upper atmosphere. For the existence of the charge there is necessary a mechanism explaining the origin of sufficiently strong electric fields with a potential E exceeding the penetrating value E_{pen}. The gas discharge in the atmosphere applied to the aurora is considered as arising in induced electric fields and it is shown that electrical induction fields in the meteor region have a potential of $E_0 = 10^8$ v/cm. The passage of a meteor in the upper atmosphere is accompanied by the formation of an entirely ionized trail of electrons and ions of meteoric matter so that the meteoric particles form a cloud of well conducting gas surrounded by gas with considerably less conductivity. In order to compute the effect of intensification of the electric field near the end of a meteoric trail the latter is approximated by a very extended ellipsoid of rotation. The intensification of the electrical field near the apex is given by

$$E_{max} = \left(\frac{l}{r_t}\right)\frac{E_0}{\lg(2l/r_t) - 1}$$

where $r_t^2 = 4Dt + r_0^2$ = effective radius of the trail (small semiaxis of the ellipse), D = diffusion coefficient and r_0 = initial radius of the trail. The intensification of the field E_0 is most intense in the interior part of the trail. The penetrating value of the potential of the electrical field leading to the formation of an electric gas discharge can be found by means of $E' = Ap/B + \lg(pd)$ where p = gas pressure in mm Hg; d = length of discharge interval in cm; A and B constants associated with the coefficients of ionization into electrons and ions. Perpendicularly to the magnetic field of the earth the potential of penetration increases, namely: $E'' = (\sigma_0/\sigma_1)E'$, where σ_0 and σ_1 = electrical conductivity along and across the geomagnetic field. The intensification of the electric field near the flying meteor is shown to lead to the formation of one form of gas discharge. It is concluded that the luminous aureola adjacent to the moving meteor is a product of the corona of the anterior part of the ionized trail. During the spark discharge the electric current along the trail increases so that the earth's magnetic field may be caused to pulsate. An equation for computing the entire current I_0 through the cross section of the trail is developed, namely:

$$I_0 = \int_0^{\infty}\int_0^{2\pi} r j_0(r,l)\, dr d\varphi = \frac{\sigma Q E_0}{1 + kQ}$$

where Q = linear density of electrons; k = coefficient of recombination; $j_0 = \Sigma E_0$, where conductivity $\sigma = eN(r,l)$. *Subject Headings:* **1. Electrical discharge in gases 2. Meteor ionization trails.**—*L.D.* Ⓢ

11L–169 621.396.6:523.531

Fialko, E. I. (*Tomsk Poly. Inst.*), **A new method for determining the radiant of a meteor stream, using an antenna of low directivity.** *Soviet Astronomy AJ*, New York, 3(1):136–138, Jan./Feb. **1959.** 3 figs., 2 refs. **DLC.** Transl. of **Novyĭ metod opredeleniia radianta meteornogo potoka s pol'zovaniem slabonapravlennoĭ antenny,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(1):134–136, Jan./Feb. **1959. DLC**—The possibility of measuring the coordinates of a meteor stream using an antenna of low directivity is considered. *Subject Headings:* **1. Antennas 2. Radio meteor measurement techniques 3. Meteor radiant distribution.**—*Author's abstract.* Ⓢ

11L–170 523.5:551.594.12:551.590.25

Fialko, E. I. (*Tomsk Poly. Inst.*), **An approximate estimation of the probability of meteoric ionization.** *Soviet Astronomy AJ*, New York, 3(3):479–483, Dec. **1959.** 15 refs., 17 eqs. **DLC.** Transl. of **Priblizhennaia otsenka veroiatnosti meteornoĭ ionizatsii,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(3):491–495, May/June **1959. DLC**—An approximate estimation is made of the exponent n, which characterizes the relation of the probability of ionization to meteor velocity. *Subject Headings:* **1. Meteor ionization 2. Meteor velocities.**—*Author's abstract.* Ⓢ

11L–171 523.5:551.510.535:551.594.12:551.590.25

Fialko, E. I., **O veroiatnosti meteornoĭ ionizatsii.** [Probability of meteoric ionization.] *Radiotekhnika i Elektronika*, Moscow, 4(7):1206–1208, July **1959.** 4 figs., 12 refs. **DLC**—The probability of ionization (β) is defined as "the probability of the production of a free electron as a result of the evaporation of one meteoric atom and its collision with atmospheric particles." The dependence of this probability upon meteoric velocity (v) may be expressed as $\beta(v) = av^n$, where a and n are constants (for n different values between 0 and 5.6 have been obtained empirically). In this paper a study of the relationships between meteor velocity, the n coefficient, intensity of initial radar signal and radar wave length is reported and shown graphically. The largest number of meteors

was found to register at meteoric velocities of 55 km/s (8.13 m wave length; $n = 1.5$). Visual mete observations were used to determine the selectivity of radar detection. *Subject Heading:* **1. Mete ionization.**—*G.T.* Ⓢ

11L–172 523.5:551.501.81:551.590.25:533.

Fialko, E. I., **Metod otsenki koeffitsienta diffuzii v meteornoĭ zone.** [Method of estimati the diffusion coefficient in a meteoric zone.] *Radiotekhnika i Elektronika*, Moscow, 4(7):1208–121 July **1959.** 2 figs., 3 refs., 4 eqs. **DLC**—The coefficient of meteor mass distribution may be o tained both from the distribution of transient radio echo duration and from the distribution of stab radio echo duration. From the coefficients of mass distribution obtained by the two differe methods, the diffusion coefficient may be obtained. The formulas to be used are derived in th paper. It is also noted that since the diffusion coefficient is a function of height, for typical heigh the dependence of the diffusion coefficient on meteor velocity may be obtained. Results of mete echo observations at 10 m wave length (Tomsk, Jan. 9, 1957) are presented; they yield a diffusio coefficient of 2.8 m^2/s at 90 km height, corresponding to a meteor velocity of 28 km/s. *Subje Headings:* **1. Diffusion in upper atmosphere 2. Radio echoes from meteors.**—*G.T.* Ⓢ

11L–173 523.5:523.1

Fialko, E. I., **K voprosu o raspredelenii meteornykh tel po skorostiam.** [Velocity distributio of meteoroids.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(2):354 356, March/April **1960.** 3 figs 6 refs. Russian and English summaries p. 354. Transl. into English in *Soviet Astronomy A.* New York, 4(2):334 336, **1960. DLC**—The velocity distribution of meteoroids differs from th velocity distribution of meteors as measured by radar. Although the radar method is selectiv it may be considered on the basis of the results of meteor velocity measurement that the relativ number of meteoroids of interstellar origin is extremely small. *Subject Headings:* **1. Meteor showe 2. Interstellar matter.**—*Author's abstract.* Ⓢ

11L–174 551.501.8:523

Fialko, E. I. (*Tomsk Polytech. Inst.*), **Raspredelenie meteornykh radioekho po dlitel'nost I, Otrazheniia ot ustoĭchivykh sledov.** [Distribution of meteor radio echoes by duration, Pt. Reflections from stable trails.] *Astronomicheskiĭ Zhurnal*, Moscow, 36(5):867–873, Sept./Oct. 195 3 figs., 4 refs., 40 eqs. **II, Otrazheniia ot neustoĭchivykh sledov.** [Pt. 2, Reflections from unstabl trails.] *Ibid.*, 37(3):526–529, May/June **1960.** fig., 4 refs., 11 eqs. English and Russian sum maries. Transl. into English in *Soviet Astronomy AJ*, New York, 5(5):842–848, March/April 196 and 4(3):498–501, Nov./Dec. **1960. DLC**—The distribution of meteor echoes intercepted from sector is considered with respect to the duration of the reflections. Analytical expressions ar derived, considering the distribution of meteors by mass, the velocity of meteoric bodies and th radar wavelength. Measurements appear to be in general agreement with the formulas. *Subje Headings:* **1. Radio echoes from meteors 2. Meteor echo duration.**—*From author's abstracts.* Ⓢ

11L–175 523.

Greenhow, J. S. and Hall, J. E. (*both, Jodrell Bank Experimental Station*), **The variation o meteor heights with velocity and magnitude.** *Royal Astronomical Society, London, Monthly Notice* 121(2):174–182, **1960.** 3 figs., 19 refs., 11 eqs. **DLC**—The variation of the heights of occurrenc of meteors, with velocity and magnitude, are compared with theoretical predictions. The photo graphic observations are shown to be in good agreement with theory over the range of zenitha visual magnitudes from -3 to $+3$ and for velocities of 13 to 70 km/sec. Very large departure from the predicted heights are found for radio echo observations of $+6$ magnitude meteors. Reason for these departures are discussed. *Subject Heading:* **1. Meteor heights.**—*Authors' abstract.* Ⓢ

11L–176 551.501.8:523.

Greenhow, J. S. and Hall, J. E. (*both: Jodrell Bank Experimental Station*), **The importance o initial trail radius on the apparent height and number distributions of meteor echoes.** *Roya Astronomical Society, London, Monthly Notices*, 121(2):183 196, **1960.** 12 figs., table, 19 refs **DLC**—Some simultaneous radio echo observations of meteors at wavelengths of 8 m and 17 m ar described. It is shown that very many more echoes from faint $+6$ mag. meteors are observed a 17 m than at the shorter wave length, and this effect is attributed to an attenuation in echo amplitud due to the large initial radii of the ionized trails. The initial radius is found to increase from 1 m t 3 m between the heights of 90 and 115 km. It is estimated that radio echo equipments of moderat sensitivity detect only 1.5 percent of $+6$ mag. meteors at a wave length of 4 m, 8 percent at 8 m rising to 40 percent at 17 m. The influence of this large attenuation in echo amplitude on mete wave radio echo observations of meteor height, mass, and velocity distributions is considered *Subject Heading:* **1. Radio echoes from meteors.**—*Authors' abstract.* Ⓢ

11L–177 551.501.8:523.5

Kaiser, T. R., **The determination of the incident flux of radio meteors.** *Royal Astronomical ciety, London, Monthly Notices*, 121(3):284–298, Sept. **1960.** 12 figs., 15 refs., 35 eqs. **DLC**—The served rate of radio meteors depends on a number of factors which includes: (1) the incident flux d distribution in magnitude of the meteors, (2) the radiant co-ordinates, (3) the variation in ization along a meteor trail, (4) the nature of the radio reflection process and (5) the parameters the radio echo equipment. The present work represents a considerable simplification over evious attempts to relate the radio echo rate to the actual flux of meteoroids. Simple formulas e derived relating these two quantities which, when used together with suitable graphical repre- ntation of the directional properties of the aerial system and of the reflection geometry, enable e incident flux of shower meteors to be deduced from the observed rate. The fact that the variation th time of the shower rate obtained with a fixed aerial beam may be predicted is relevant in connec- on with a method for shower radiant determination. Limitations due to the approximations in the eory and to the simplified ablation theory on which it is based, are discussed. *Subject Heading:* **Radio echoes from meteors.**—*Author's abstract.* Ⓢ

11L–178 523.164.85:523.5

Katasev, L. A.; Korpusov, V. N. and Orlianskii, A. D. (*all, Inst. of Applied Geophysics, Acad. Sci., U.S.S.R.*), **Radar-echo observations of meteors using two receivers of different sensitivity.** *viet Astronomy AJ*, New York, 4(1):110–113, July/Aug. **1960.** fig., 2 tables, 5 refs., 6 eqs. **DLC.** ransl. of **Radiolokatsiia meteorov s dvumia priemnikami razlichnoi chuvstvitel'nosti,** *Astro- micheskiĭ Zhurnal*, Moscow, 37(1):115–118, Jan./Feb. **1960. DLC**—Results are given of a study the S parameter of the distribution of meteoric bodies with respect to mass for the 1959 Quadrantid ower. It is shown that S did not remain constant, but varied with time, and reached a peak value 2.96 at about 5^h–7^h UT on Jan. 4, 1959. Derivation of a formula for determining the diffusion efficient D on the basis of radar echo observations of meteor, using two receiving sets of unequal nsitivity, is given. *Subject Heading:* **1. Radar echoes from meteors.**—*Authors' abstract.* Ⓢ

11L–179 523.164.85 551.510.62:523.5

Nemirova, E. K. (*Tomsk Polytech. Inst.*), **Some results of preliminary observations of resonance attering of radio waves by meteor trails.** *Soviet Astronomy AJ*, New York, 3(2):371–373, March/ pril **1959.** fig., 2 tables, 2 refs. **DLC.** Transl. of **Nekotorye rezul'taty predvaritel'nykh nabliu- eniĭ rezonansnogo rasseianiia radiovoln meteornymi sledami,** *Astronomicheskiĭ Zhurnal*, Moscow, 5(2):377–379, March/April **1959. DLC**—Special observations for an experimental investigation the influence of resonance, during the scattering of radio waves by meteor trails, on the accuracy the determination of some meteor characteristics are being made at the Tomsk Polytechnical nstitute. In the present paper some results of preliminary observations are given. *Subject Head- ngs:* **1. Resonance scattering 2. Radio wave scattering by meteor trails.**—*Author's abstract.* Ⓢ

11L–180 523.164.85:523.5

Nemirova, E. K., **The role of resonance effects in the measurement of meteor velocities.** *oviet Astronomy AJ*, New York, 3(3):470–474, Dec. **1959.** 7 figs., 6 refs., 2 eqs. **DLC.** Transl. of **roli rezonansnykh effektov pri izmerenii skorosteĭ meteorov,** *Astronomicheskiĭ Zhurnal*, Moscow, 6(3):481–486, May/June **1959. DLC**—Some features of resonance scattering of radio waves by meteor trails are considered. An estimate is made of the influence of resonance on the form of the diffraction pattern and on the accuracy of the measurement of meteor velocities by the pulse-diffrac- on method. *Subject Headings:* **1. Meteor velocity measurement techniques 2. Resonance scatter- ng 3. Radio wave scattering by meteor trails.**—*Author's abstract.* Ⓢ

11L–181 551.510.62:523.5:621.396.9

Kent, G. S. (*Univ. College of Ibadan, Nigeria*), **The fading of radio waves reflected obliquely om meteor trails.** *Journal of Atmospheric and Terrestrial Physics*, London, 19(3/4):272–283, Dec. **1960.** 6 figs., table, 12 refs. **DWB**—A study has been made of bursts of signal received at Cambridge over a distance of 500 km from the 53.25 Mc/s BBC television transmitter at Kirk o' Shotts. These signal bursts, believed to be due to reflections from meteor trails, were usually found to fade at a rate of several cycles per second. This fading is believed to be due to changes in the diffraction pattern formed on the ground by waves scattered from separate parts of a meteor trail. By observing the signal bursts on two aerials spaced 200 m apart deductions have been made about the size of the structure in the diffraction pattern and the way in which it changes with time. It is concluded that the scale of the diffraction pattern is determined by the total length of the meteor trail rather than by the size of the individual irregularities into which it breaks and the value found for the mean trail length is in good agreement with that found by other workers. The fading is found to be due to two causes, to random movements inside the trail and to rotation of the trail as a unit under the action of a wind shear. Values deduced for the r.m.s. random velocity and for the

wind shear are again in agreement with those believed to exist in the E region. *Subject Headin* **1. Meteor trail radio transmission 2. Radio reflections from meteor trails.**—*Author's abstract.* Ⓢ

11L-182 523.5:551.590.25:621:39

Carpenter, R. J. (*Natl. Bureau of Standards, Wash., D. C.*) and Ochs, G. R. (*Natl. Bureau Standards, Boulder, Colo.*). **The NBS meteor burst communication system.** *Institute of Ra Engineers, N. Y. Professional Group on Communications Systems, Transactions,* CS-7(4):263 2 Dec. **1959.** 11 figs., 7 bibl. refs., 3 eqs. **DLC** This project was undertaken in 1955 to investig the properties of the intermittent reception of VHF signals over long distances by meteoric propa tion and their communication usefulness. To accomplish this, a complete duplex teletype syst operating at about 50 Mc was constructed, and results are reported from tests made over a 1277-l east west path. Comparisons are made of burst transmissions of 10, 20, 40, and 80 times norm teletype speed and of variations in a number of control system parameters. For the system unc tests, the optimum speedup was 40×, which produced a daily average channel capacity of abo 40 wpm with a character error rate of about 0.0035 (with the best control system settings). High speedup ratios are advocated for future systems. The most serious causes of outages in this ty of system are atmospheric noise and sustained multipath distortion from competing modes such E, and auroral propagation. *Subject Headings:* **1. Radio meteor trail communication 2. Mete trail radio transmission.**—*Authors' abstract.* Ⓢ

11L-183 621.396.9:52

Sugar, George R., **Loss in channel capacity resulting from starting delay in meteor-burst co munication.** *U. S. National Bureau of Standards, Journal of Research, Sec. D,* 64(5):493 494, Sep Oct. **1960.** fig., 4 refs., 5 eqs. **DWB, DLC** The loss in channel capacity of a meteor burst co munication system is computed as a function of the time required to initiate control of the syste The result is compared with various experimental data and appears to be applicable for signal bur up to one-half second in duration. It is noted that in the very high frequency range the loss shou increase with frequency. *Subject Headings:* **1. Radio meteor trail communication 2. Meteor tr radio transmission.**—*Author's abstract.* Ⓢ

11L-184 621.396.9:52

Sugar, George R.; Carpenter, Robert J.; Ochs, Gerard R., **Elementary considerations of t effects of multipath propagation in meteor-burst communication.** *U. S. National Bureau of Stan ards, Journal of Research, Sec. D,* 64(5):495 500, Sept./Oct. **1960.** 4 figs., table, 11 refs. **DW DLC** Three mechanisms likely to produce regularly multipath propagation, are examined. The are: (1) the simultaneous existence of two meteor trails; (2) the existence of a Rayleigh-fading bac ground continuum; and (3) the existence of two first-Fresnel zones along a single meteor trail. A analysis of the first mechanism indicated that in a typical meteor-burst communication system tw trail propagation would cause transmission errors at a rate directly proportional to the system du cycle. Satisfactory agreement was obtained between predicted and observed error rates for such system. An examination of the significance of interference from the continuum in some wide-ban transmission tests indicated that this source of multipath could be responsible for a significa fraction of the errors observed. The third mechanism was examined to determine the magnitu of the multipath delays it could produce. It was found that the effect of this single-trail multipa was likely to be significant only for the transmission rates in excess of 2×10^4 bauds. However, t results of measurements at a rate of 10^6 bauds indicated that even at this high rate over one-half of t transmissions were error free and that this latter type of multipath may not be of much importan in system design. *Subject Headings:* **1. Radio meteor trail communication 2. Meteor trail rad transmission.**—*Authors' abstract.* Ⓢ

11L-185 621.396.9:523

Wheelon, Albert D., **Amplitude distribution for radio signals reflected by meteor trails, Pt.** *U. S. National Bureau of Standards, Journal of Research, Sec. D,* 64(5):449-454, Sept./Oct. 196 4 figs., 3 eqs. **DWB, DLC** The probability distribution for the envelope of the received sign composed of reflections from many meteor trails is derived theoretically. Both the effects of nume ous small meteors and the residual reflections from infrequent and large meteors are treated simu taneously. For the particular example of exponential decay of initial spikes which are themselv distributed as the inverse square of their amplitudes, we find the probability that the composi residual signal amplitude exceeds a prescribed level r is given by

$$P(R>r) = \frac{1}{1+\left[\frac{r^2}{(vn\bar{Q})^2}\right]^{\frac{1}{2}}}$$

This function behaves as a Rayleigh distribution for small amplitude margins r. For the larger, less likely amplitudes it agrees with the result predicted by elementary analysis of isolated meteor reflections. Possible refinements of these results are also discussed. A second paper will discuss time correlation of composite meteor signals at different times. *Subject Heading:* **1. Radio reflections from meteor trails.**—*Author's abstract.* Ⓢ

METEOR SHOWERS

11L–186 621.396.9:523.53

Dagaev, M. M., **Meteornyĭ dozhd'.** [A meteoric rain.] *Priroda*, Moscow, No. 10:125, Oct. **1959. DLC**—After mentioning that an encounter of the Earth with the main accumulation of the Dragonide meteoric flow will take place in Oct. 1959, the author discusses similar preceding encounters during which a meteoric rain was observed in the European U.S.S.R., Western Europe and Africa (Oct. 9, 1933) and Ireland and Spain (Oct. 10, 1946). Although the Earth happens to be close to the Giacobini-Zinner Comet on Oct. 9 every year the strong meteoric flow produced by its tail is particularly intense only every 13 years. *Subject Headings:* **1. Meteor showers 2. Comet Giacobini-Zinner.**—*A.M.P.* Ⓢ

11L–187 621.396.9:523.53

Murphy, K. W., **Meteors: showers and sporadic.** *Astronomical Society of Victoria*, [*Australia*], *Journal*, 12(1):9–11, April **1959. DLC**—A descriptive account of meteors, especially of meteor showers. Their characteristics as revealed by velocity measurements are discussed and the various techniques of velocity measurement are described. The controversial question as to whether some meteors are confined to the solar system, and others are of interstellar origin has also been examined. In this regard the experiments conducted by Jodrell Bank indicate that even if interstellar meteors exist, they represent less than one percent of the total number of meteors. *Subject Headings:* **1. Meteors 2. Meteor showers.**—*I.S.* Ⓢ

11L–188 621.396.9:523.531

Makovetskiĭ, P. V. (*Leningrad Inst.*), **The antiradiant of a meteor stream.** *Soviet Astronomy AJ*, New York, 3(3):475–478, Dec. **1959.** fig., 5 refs., eq. **DLC.** Transl. of **Antiradiant meteornogo potoka,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(3):487–490, May/June **1959. DLC**—The deformation in the density of a meteor stream due to the gravitational forces of a planet which crosses the stream, is discussed. A zone of increased density of meteors is formed near the planet in a direction opposite to the radiant; this zone being a danger to space ships. Observations of the occultation of the radiant by the moon can give new data on the parameters of the stream and the atmosphere of the moon. *Subject Heading:* **1. Meteor shower radiants.**—*Author's abstract.* Ⓢ

11L–189 521.73 621.396.9:523.531

O'Keefe, John A., **A probable natural satellite: the meteor procession of February 9, 1913.** *Royal Astronomical Society of Canada, Journal*, 53(2):59–65, April **1959.** 3 tables, 9 refs., 2 eqs. **DLC**—This is a discussion of the characteristics of the meteoric procession of Feb. 9, 1913. The author concludes that the meteors of this display were travelling in a satellitic orbit around the earth. The elements of the orbit were approximately: period 90 minutes, inclination 51°6, eccentricity 0, terrestrial longitude of descending node 33°20'W, and time of passage of descending node 2:20 U.T. Feb. 10, 1913. Altitudes and azimuths of the apparent radiant calculated from this orbit are presented; they agree with the observations. *Subject Headings:* **1. Satellite orbits 2. Meteor orbits.**—*E.Z.S.* Ⓢ

11L–190 523.531:778.3

Wright, Frances W. (*Harvard College Obs., Cambridge, Mass.*), **An observation concerning mean radiant paths of photographic meteor showers.** *Astronomical Journal*, New Haven, Conn., 65(1):33–39, Feb. **1960.** 4 figs., 4 tables, 16 refs., 8 eqs. **DLC**—A survey of 12 meteor showers photographed at Harvard indicates that the sun is never more than a few degrees from the extended great circle through the mean daily path of radiant motion for the corresponding shower. When the earth takes some time in passing through the stream, the daily radiant seems to advance along a great circle path towards the position of the sun at the time of maximum shower activity. This observation can be explained if we assume that when the earth encounters individual members of a meteor stream, the heliocentric velocity vectors of these individual members are approximately parallel. The observation can prove to be a convenient tool in the future whenever the data for a meteor shower are few or inaccurate. *Subject Headings:* **1. Meteor shower observation techniques 2. Meteor photography.**—*Author's abstract.* Ⓢ

11L–191 523.531:778.3

Wright, Frances W.; Jacchia, Luigi G. and Boehm, Barry W. (*all, Harvard College Obs., Cambridge, Mass.*), **Photographic lyrid meteors.** *Astronomical Journal*, New Haven, Conn., 65(1):40–45, Feb. **1960.** 3 figs., 5 tables, 16 refs., 2 eqs. **DLC**—This analysis shows that the mean radiant path of the photographic Lyrids has a daily motion of 16′ eastward and 10′ northward with respect to the equator in the interval from April 7 through April 23 UT. The mean deviation of an extended meteor trail from the mean moving radiant is ±23′. This value is in general agreement with the relation between meteor stream widths and radiant deviations which was derived for eleven other photographic streams. At the time of maximum activity of the Lyrids, on April 22 UT, the sun is only 6° from the extended mean radiant path. This agrees with a recent observation by one of the authors that the sun is never more than a few degrees from the extended mean radiant path of a meteor shower near the time of maximum activity. *Subject Headings:* **1. Meteor photography 2. Meteor shower radiants.**—*Authors' abstract.* Ⓢ

11L–192 551.501.81:523.164.85:523.532

Dudnik, B. S.; Kashcheev, B. L.; Lagutin, M. F. et al., **The velocity of meteors of the Geminid shower.** *Soviet Astronomy AJ*, New York, 3(1):143–146, Jan./Feb. **1959.** 6 figs., 2 refs., 3 eqs. **DLC.** Transl. of **Skorost' meteorov v potoke Geminid,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(1): 141–145, Jan./Feb. **1959. DLC**—The results of measurements of meteor velocities by radar-echo techniques during the Geminid shower, are given. Measurements are carried out from 23^h to 5^h UT from Dec. 10–14. The bulk of the 569 velocity measurements (for 226 meteors) fell within a range of 32.5–37.5 km/sec; the average velocity over that range was 35.9 km/sec. The radiants of the meteors were not determined, and sporadics are therefore not excluded from the total quantity. *Subject Headings:* **1. Radar echoes from meteors 2. Meteor velocities. I. Lysenko, I. A.**—*Authors' abstract.* Ⓢ

11L–193 523.164.85:523.532

Fialko, E. I. (*Tomsk Polytech. Inst.*), **Radar observations of the Perseids during 1957.** *Soviet Astronomy AJ*, New York, 3(2):306–309, March/April **1959.** 4 figs., 7 refs., 3 eqs. **DLC.** Transl. of **Radiolokatsionnye nabliudeniia Perseid v 1957 g,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(2):311–314, March/April **1959. DLC**—During 24 hour radio echo observations on $\lambda = 10$ m made during Aug. 11–12, 1957 in Tomsk, two maxima (a daytime and nighttime) in the number of radio echoes were registered. The daytime maximum (as well as the nighttime) is due to the Perseid stream. *Subject Headings:* **1. Radar echoes from meteors 2. Perseids.**—*Author's abstract.* Ⓢ

11L–194 523.532

Kashcheev, B. L. and Lebedinets, V. N., **On the structure of the Geminid meteor shower.** *Soviet Astronomy AJ*, New York, 3(4):615–625, Jan./Feb. **1960.** 11 figs., 3 tables, 15 refs., 5 eqs. **DLC.** Transl. of **O strukture meteornogo potoka Geminid,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(4):629–640, July/Aug. **1959. DLC**—Measurements were made of meteor activity during the epoch of the Geminid meteor stream, Dec. 10–19, 1958. The distribution by mass of sporadics was found to be $N = N_0/m^2$. The maximum of the shower was observed during the night of Dec. 13–14. The maximum hourly rate of occurrence of meteors was 945. At the moment of maximum activity, the distribution of meteoric bodies according to mass changed abruptly and an increase in the number of large particles was observed. The central condensation has a cross section measuring over $5 \cdot 10^5$ km across. Distribution according to mass in the middle of the stream is $N = N_0/m^{1.3}$ at $m > 0.02$ g and $N = N_0/m^{2.2}$ at $m < 0.02$ g. On Dec. 12, from 0h to 2h, the earth passed through a condensation of large meteoric bodies in the stream. A maximum was observed for the large particles only. The transverse section of the condensation is estimated at $2 \cdot 10^5$ or at $5 \cdot 10^4$. *Subject Headings:* **1. Meteor showers 2. Geminid meteor stream, 1958.**—*Authors' abstract.* Ⓢ

METEOR SPECTRA

11L–195 535.33:523.51

Halliday, Ian (*Dominion Obs., Ottawa*), **The spectrum of an asteroidal meteor fragment.** *Astrophysical Journal*, Chicago, 132(2)L482–485, Sept. **1960.** fig., 3 tables, 11 refs. **DWB, DLC**—A study has been made of an unusual meteor spectrum which contains only lines of neutral iron and a weak continuum. The absence of the *D* lines of sodium is particularly noteworthy and supports the meteoric, rather than atmospheric, origin for sodium in normal meteor spectra. The atmospheric velocity was only 13 km/sec. The orbit has a short period, small eccentricity, and low inclination to the ecliptic. The evidence indicates that the meteoroid must have been a nickel-iron fragment of asteroidal, rather than cometary, origin. *Subject Heading:* **1. Meteor spectra.**—*Author's abstract.* Ⓢ

11L–196 535.242:523.43 523.51

Kitamura, Masatoshi (*Tokyo Astron. Obs.*), **A photoelectric study of colors of asteroids and meteorites.** *Astronomical Society of Japan, Tokyo, Publications*, 11(2):79–89, **1959.** 7 figs., 7 tables, 10 refs. **DLC**—Photoelectric observations of the colors of 42 asteroids were made with the 26-inch refractor from 1953 to 1956, with two color filters, whose effective wave lengths combined with a photomultiplier tube were 4760 A and 5610 A. It is found that asteroids showed no color variation within the precision of $\pm 0^{m}.02$ throughout the observed nights. Some asteroids were observed in both 1954 and 1956, but appreciable color discrepancy could hardly be recognized between the two years. Though an attempt was made to examine relations between colors and proper orbital elements, no close correlation could be found. For comparison with the asteroidal colors, the reflectivities of freshly exposed surfaces of meteorites and some rocks originated in the earth interior were measured against the standard light operated at a color temperature near 6000°K. The result shows that the colors of meteorites and asteroids are quite similar as a whole and that the colors of the rocks are also alike to those of meteorites. *Subject Headings:* **1. Photoelectric observation techniques 2. Meteor spectra.**—*Author's abstract.* Ⓢ

11L–197 523.57

Millman, Peter M. (*Natl. Res. Council, Ottawa*), **Photographic meteor spectra.** *Royal Astronomical Society of Canada, Journal*, 53(6):271–276, Dec. **1959.** fig., 2 tables, 8 refs. **DLC**—Though primarily concerned with the spectra photographed in 1958, 25 records from earlier years are included. In addition to these, 63 meteor spectra were secured in 1958. This brings the world total up to 318, where each meteor is counted only once. The distribution among countries of these meteor spectra is tabulated. *Subject Heading:* **1. Meteor spectra.**—*E.S.* Ⓢ

11L–198 523.532:523.841.372.4:546.17:535.33

Russell, John A. (*Univ. of Southern Calif.*), **Molecular nitrogen in the spectra of two Perseid meteors.** *Astronomical Society of the Pacific, San Francisco, Publications*, 72(427):291–295, Aug. **1960.** table, plate, 10 refs. **DLC**—The spectra of two Perseid meteors are described in this paper. One Perseid spectrum was obtained in 1951 with an aerial camera and a rotating shutter. Another Perseid spectrum, also photographically reproduced, was obtained on 12 Aug. 1958 with the 18-inch Schmidt telescope of the Palomar Observatory. These spectra exhibit the nitrogen bands as very prominent, independent features, in one case showing incipient resolution. *Subject Headings:* **1. Meteor spectra 2. Nitrogen bands.**—*I.S.* Ⓢ

11L–199 523.57

Nicholls, R. W.; Watson, M. D. and Parkinson, W. H. (*all, Univ. of Western Ontario, London*), **The laboratory excitation of meteoritic spectra in shock tubes (Canadian Scientists Report, Pt. 18).** *Royal Astronomical Society of Canada, Journal*, 53(5):223–231, Oct. **1959.** 3 figs., 2 tables, 16 refs. **DLC**—This is a report on laboratory experiments concerning shock excitation of powdered meteorites. The meteorite specimens and experimental methods used are described. A sequence of spectra of the luminosities from the shock excited Dresden meteorite specimen is shown for a series of increasing Mach numbers. The spectra are all of atomic lines whose richness increases with increasing Mach numbers. The excitation of luminosity from meteors in the upper atmosphere and of the meteorite specimens in the shock tube arise through energy transfer processes between the atmosphere which envelops the solid particle involved and the particle itself. Finally, it is pointed out that at no stage of the experiment did molecular spectra appear. *Subject Heading:* **1. Meteorite spectra.**—*E.Z.S.* Ⓢ

ZODIACAL LIGHT

11L–200 523.59:551.593.51:551.521.326

Divari, N. B. and Asaad, A. S., **On the emission of the green line of the night sky in zodiacal light.** *Soviet Astronomy AJ*, New York, 3(2):320–325, March/April **1959.** 5 figs., 3 tables, 12 refs. **DLC.** Transl. of **Ob izluchenii zelenoĭ linii nochnogo neba v Zodiakal'nom svete,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(2):327–333, March/April **1959. DLC**—On the basis of observations made in Egypt in 1957 it is shown that there is no strengthening of the green line (OI) λ5577 of the night sky in the zodiacal light. *Subject Headings:* **1. Green line emission 2. Night sky luminescence 3. Zodiacal light.**—*Authors' abstract.* Ⓢ

11L–201 523.59:535.242

Divari, N. B. and Asaad, A. S., **Photoelectric observations of the zodiacal light in Egypt.** *Soviet Astronomy AJ*, New York, 3(5):832–838, March/April **1960.** 4 figs., 7 tables, 10 refs., numerous eqs. **DLC.** Transl. of **Fotoelektricheskie nabliudeniia Zodiakal'nogo sveta v Egipte,** *Astronomicheskiĭ*

Zhurnal, Moscow, 36(5):856–862, Sept./Oct. **1959. DLC**—The result of photoelectric observations of the zodiacal light conducted in Oct. and Nov. near Aswan (Egyptian sector of the United Arab Republic) are given. Isophotes of the zodical light based on observations using yellow and green filters, and using an interference filter filtered at λ533 mμ, were plotted. The axis of the zodiacal light proved to lie very close to the ecliptic. The decrease in brightness in the direction perpendicular to the ecliptic proceeds more rapidly in the southerly than in the northerly direction. However, broadening of the isophotes of the order observed at intermediate latitudes was not observed. The maximum degree of polarization was 22%. The color index averaged at +0.35. *Subject Headings:* **1. Zodiacal light 2. Photoelectric observation techniques.**—*Authors' abstract.* Ⓢ

11L–202 523.59:551.593.9:523.16

Fesenkov, V. G., **O prirode Zodiakal'nogo sveta.** [The nature of zodiacal light.] *Meteoritika*, Moscow, Vol. 17:107–115, **1959.** 3 figs., 10 refs., 3 eqs. **DLC**—In Sept. 1957 the IGY Committee of the Academy of Sciences of the U.S.S.R. dispatched an expedition to Egypt to investigate under the most favorable conditions the properties of the zodiacal light. Observations were made to verify the hypothesis that zodiacal light is produced by the scattering of solar light by fine cosmic dust resulting from the continuous disintegration of asteroids and meteorites concentrated primarily between the orbits of Mars and Jupiter. The finest particles are swept out beyond the solar system by light pressure and the large particles are slowed down gradually by radiation pressure and settle on the Sun. The dry aerosol observed under the condition of the Libian Desert represents hypothetical meteoric particles in interplanetary space. By obtaining expressions for functions of light scattering characterizing the external forms of the zodiacal light, its system of isophots is devised by preceding from the distribution of angles of inclination of the orbits of asteroids to the ecliptic. The theoretically obtained isophots were found to correspond to the form of the zodiacal light absence in Egypt perpendicular to the horizon, when this phenomenon attained its maximum brightness. On the assumption that meteoric particles scatter sunlight, the lower limit of the density of zodiacal light estimated form brightness values is approximately 10^{-24} g/cm³ as compared with 5×10^{-24} g/cm³. The known value of meteoric matter is interplanetary space. On the basis of evidence that the orientation of polarization vectors is a pure gas and of dry aerosol are similar, it is concluded that the zodiacal light originates from dust. The color of the zodiacal light which differs slightly from sunlight can be explained by assuming that it consists of dust particles greater than 1μ. *Subject Headings:* **1. Zodiacal light theories 2. Interplanetary matter.**—*I.L.D.* Ⓢ

11L–203 523.59:551.593.55

Fesenkov, V. G., **K voprosu o prirode protivosiianiia.** [The nature of counterglow.] *Meteoritika*, Moscow, Vol. 17:116–120, **1959.** fig., 12 refs. **DLC**—The hypothesis is advanced that the counterglow is essentially an optical phenomenon of the same type as glories, that is the product of scattering indices at angles close to 180°. In a mixture of particles of various size encountered under natural conditions similar maxima and minima of scattering overlap so that the indices are smoothed out; but if each of the similar partial indices has a maximum at an angle of dispersion of 180° this maximum will be maintained and will produce the phenomenon of counterglow. The phenomenon of counterglow, its brightness and its dependence upon the observer, polarization of the counterglow, etc. are discussed. SIEDENTOPF'S calculation of the relative distribution of brightness in the counterglow indicates an increase in brightness at the antisolar point which is characteristic of the counterglow. This relationship does not depend upon the number of particles but it involves the reflective capacity of the particles which can be determined by comparison with observations. But since the initial expression of BUCESIUS upon which the SIEDENTOPF equation depends is not only roughly approximate but also not true; the observed and computed results do not agree. It is shown that if the counterglow can be observed in a pure form without other components of the night sky superposed upon it, it would be in the case of water particles, characterized by a dark ring of spherical or oval shape surrounding a somewhat brighter control part on the side opposite the sun. This theoretical picture should be eliminated as a consequence of the fact that the real particles cannot be water drops but at best possess optical properties between $m=\alpha$ and $m=1.33$. Hence the theoretical dark ring surrounding the brighter part will be expressed with less contract, if indeed it should exist. In the final analysis the theory of VAN DE HULST that the most probable hypothesis of the nature of the counterglow is that it is a projection of the gaseous train of the earth upon the sky is most acceptable. *Subject Heading:* **1. Counterglow.**—*I.L.D.* Ⓢ

11L–204 551.593.9:523.59:523.43:523.16

Fesenkov, V. G., **Ob usloviiakh dezintegratsii asteroidov po nabliudaemym osobennostiam Zodiakal'nogo sveta.** [Conditions of disintegration of asteroids according to the observed characteristics of zodiacal light.] *Meteoritika*, Moscow, Vol. 17:121–130, **1959.** 7 figs., 2 tables, 2 refs., 3 eqs. **DLC.** Also in: *Akademiia Nauk Kazakhskoĭ SSR. Astrofizicheskiĭ Institut. Izvestiia*, 8:3–12, **1959.**

6 figs., 2 tables, 8 refs., eqs.—The theoretical isophots of zodiacal light can be computed by assuming a given loss of distribution of the density of dust in interplanetary space as a function of distance from the sun and given form of scattering indices and by assuming that the dust arises from the disintegration of asteroids without perceptible initial relative velocity. The disintegration of asteroids is calculated from the known distribution of their orbits according to the angles of inclination to the plane of the ecliptic. A comparison of several methods of calculating the scattering indices of the dust in interplanetary space shows that the properties of the isophots of zodiacal light depend little upon the form of the scattering indices but are determined entirely by the distribution of the orbits of the dust particles according to the angles of inclination to the ecliptic. The hypothesis that the gradual disintegration of asteroids can be identified with the uniform ejection of particles in all directions with the same relative velocity is examined. If this velocity constitutes a perceptible part of the orbital velocity of the asteroid then the dust particles would be distributed sufficiently on both sides of the ecliptic and hence the isophots of zodiacal light would be correspondingly widened. The relationship between relative velocity of ejection of dust particles and their distribution according to the angles of inclination of their orbits is presented. It is shown that the function of distribution of orbits of ejected particles is constant over the entire region of possible motion for $k=0.1$ (k = coefficient determining the character of distribution of dust particles in space as a function of the heliocentric and relative to the plane of the ecliptic). In the case of $k=1$, when the relative velocity of ejection is equal to the orbital velocity, the function of distribution gradually diminishes as the angle of inclination increases. The relative total distribution of inclination in the complex of dust particles arising from asteroids is computed and this is used to calculate the corresponding theoretical isophots of zodiacal light which are compared with the observed isophots. At $k=0.1$ there was no perceptible difference from the isophots corresponding to $k=0$. The theoretical form of zodiacal light showed almost the same compressed system of isophots. In the case of $k=1$ the calculated isophots of zodiacal light showed the highly expanded form. Hence the observation can be represented by any intermediate values, in all probability by 0.4–0.5. *Subject Headings:* **1. Zodiacal light 2. Meteoric dust theory of zodiacal light.**—*I.L.D.* Ⓢ

11L–205 535.24:523.59

Fesenkov, V. G., **O metodike reduktsiĭ fotometricheskikh nabliudenii nad Zodiakal'nym svetom.** [Method of reduction of photometric observations of zodiacal light.] *Akademiia Nauk Kazakhskoĭ SSR. Astrofizicheskiĭ Institut, Izvestiia,* 9:35–39, **1959.** table, 7 refs., several eqs. English summary p. 39. **DLC**—The apparent brightness of the zodiacal light especially at the great angular distance from the sun is a very complex phenomenon depending on different components. The first component is of galactic origin and depends on the integral light of the stars, their light diffused in the interstellar medium as well as in the terrestrial atmosphere. The second component, airglow, represents the ionospheric illumination of the sky including many emission lines and bands as well as a continuous spectrum. This component is characterized by the effective height nearly equal to 200 km and is also diffused in the troposphere. The third component is produced by the Zodiacal light observed directly and by its light diffused by the troposphere. The method of reduction of the photometric observation of the zodiacal light can be proposed as follows. Let us suppose that the brightness of the sky near the celestial pole is measured under the same conditions of the time of observations on the zodiacal light. This brightness is reduced firstly by the galactic component and its light diffused in the troposphere. Further the observed apparent brightness near the pole must be accounted for of the zodiacal component in the same point of the sky. The value of this component is not definitely settled, but it is very small as it can be evaluated from suitable polarimetrical data. Taking this into account one can deduce for the celestial pole the ionospheric component only. Further ionospheric component so far obtained for one single representative point can be immediately calculated for every other point of the sky where the zodiacal light is observed as it was pointed out previously. To this ionospheric component estimated in such a manner at the corresponding zenithal distance there must be added the galactic component in the same point of the sky and the tropospheric diffused light depending upon all the causes of illumination including the zodiacal light itself. Consequently the reduction value which must be subtracted from the apparent brightness of the sky observed in the direction of the zodiacal light is the following:

$$\text{Red} = (I - \text{gal. comp. at pole} - \text{Zod. comp. at pole})\ (p-0.03)^{\sec z - \sec z_0} \sqrt{\frac{(1h)^2-\sin^2 z_0}{(1h)^2-\sin^2 z}} + \text{galac. comp. } (z,b,1) + \text{Zod. comp. (troposphere)}.$$

The true brightness of the zodiacal light corrected for the atmospheric extinction is $(I_{app.} - \text{Red})^{-\sec z}$. *Subject Headings:* **1. Zodiacal light photometry 2. Photometric observation techniques.**—*Author's abstract.* Ⓢ

COMETS

11L–206 523.6:551.594.5

Barber, D. R. (*Norman Lockyer Obs., Univ. of Exeter*), **Variable brightness of comet Burnham (1959 k) and auroral activity, 1960 April 27 30.** *Observatory*, London, 80(918):198–199, Oct. **1960.** 7 refs. **DLC** (QB1.02)—Photographic observations show the occurrence of short period variations in the integrated brightness of the comet's head with an abrupt decrease on April 27 and an increase between April 29th and 30th. Diffuse auroral glows were observed on April 27–28 and in the morning of the 30th. A moderately bright aurora with some ray activity was seen on the evening of the 30th. These observations make it appear very likely that the changes in brightness of the comet structure were related to an influx of solar particles into the earth's upper atmosphere. *Subject Headings:* **1. Comet 2. Auroras.**—*R.B.* Ⓢ

11L–207 523.6:523.821.2

Gilson, Emile, **Observation de la magnitude visuelle apparente de la comète Burnham (1959 k).** [Observation of the apparent visual magnitude of the Burnham Comet (1959 k).] *Ciel et Terre*, Brussels, 76(5/6):177–178, May/June **1960.** plate. **DWB, DLC**—Short description of the station of an amateur astronomer (and of its equipment) situated at Saint-Servais near Namur (Belgium). The author observed the Burnham Comet (1959 k) and could determine its apparent visual magnitude. He gives the detail of the observations made in comparison of the reference stars of the Ursa Minor constellation. *Subject Headings:* **1. Astronomical amateur observers 2. Comet observers 2. Comet observations.**—*A.V.* Ⓢ

11L–208 523.6:535.242

Manova, G. A.; Dokuchaeva, O. D. and Vorontsov-Vel'iaminov, B. A. (*all, State Astronom. Inst.*), **Photometry of the comet Arend-Roland, 1956h.** *Soviet Astronomy AJ*, New York, 3(6):965–969, May/June **1960.** 5 figs., 9 refs. **DLC.** Transl. of **Fotometriia komety Arenda-Rolana 1956h,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(6):1053–1057, Nov./Dec. **1959. DLC**—Isophotes of the head of the comet, based on plates taken in photographic light on April 24–25, 1957, and photometric cross sections through the cometary nucleus, are given. The conclusion arrived at is that the comet had two heads. The inner head, with rather well defined edges, is connected to rays of the tail, of type I. The second, or outer head, is of parabolic shape, with fuzzy edges connected to a type II tail. This is evidently at variance with the view that the heads of comets possessing type I tails have diffuse boundaries, while comets having type II tails are supposed to have heads with sharply defined envelopes. The brightness distribution sunward throughout the head may be represented roughly by the inverse relationship r^{-1}, which provided an excellent representation of the coma of Whipple's comet 1942g over the entire sunward hemisphere. The r^{-1} relation has no validity at all in the case of the comet Arend-Roland, in directions perpendicular to the sun-comet radius vector. An analysis of photometric data on comets, and theoretical derivation of isophotes for the comets, still remain in a primitive stage. *Subject Headings:* **1. Comet observations 2. Photometric observation techniques 3. Comet Arend-Roland.**—*Authors' abstract.* Ⓢ

11L–209 523.6:551.593.7

Martel, Marie-Thérèse (*Observatoires de Lyon et de Haute-Provence*), **Variations de la polarisation observée du 18 au 29 août dans la comète 1957d pour des régions situées à moins de 4′ du noyau.** [The changes in polarization observed for the period Aug. 18–29 in the comet 1957d in regions situated at less than 4′ from the nucleus.] *Annales d'Astrophysique*, Paris, 23(3):480–497, May/June **1960.** 12 figs., 3 tables, 20 refs. French, English and Russian summaries p. 480. **DWB, DLC**—Polarization has been measured in the nucleus and in the regions near the head (for the period August 18 to August 29, 1957), on 112 photographs, obtained with a polarimeter with a grating of metallic bars. The degree of polarization in the nucleus decreases with the phase angle. The experimental results are in rather good agreement with the theoretical values calculated for particles having an index of refraction of about 1.33 and a mean radius of 0.2 to 0.3 μ. The plane of polarization of most of the measured areas in the tail passes through the sun. The percentages of polarized light found in the tail indicate that the dust particles are practically identical with those in the head, but this result remains quite uncertain. *Subject Heading:* **1. Polarization of comets.**—*Author's abstract.* Ⓢ

11L–210 523.6:551.593.7

Martel, Marie- Thérèse, (*Observatoires de Lyon et de Haute-Provence*), **Observations polarimétriques de la Comète Giacobini-Zinner (1959b).** [Polarimetric observations of the Comet Giacobini-Zinner (1959b).] *Annales d'Astrophysique*, Paris, 23(3):498, May/June **1960.** 2 figs., 2 refs.

French, English and Russian summaries p. 498. **DWB, DLC**—Results of observations taken on Oct. 25 and 31, 1959. *Subject Headings:* **1. Polarization of comets 2. Comet Giacobini-Zinner.**—*Author's abstract.* Ⓢ

11L–211 523.6

Larsson-Leander, Gunnar (*Stockholm Obs., Saltsjöbaden*), **The anomalous tail of Comet Arend-Roland.** (In: Beer, Arthur (*ed.*), **Vistas in Astronomy,** Vol. 3, pub. **1960.** p. 137–142. 9 figs., 2 tables, 8 refs.) **DWB** (520.82 B415v), **DLC** (QB3.B35)—The geometry of the tails of Comet Arend-Roland (1956h) is studied and the anomalous tail is explained as cometary matter very strongly concentrated to the orbital plane. Tabulations of the position angles of the tails and of the deviations of the tails from the prolonged radius vector are given. Finally, the origin of the anomalous tail is commented upon. *Subject Headings:* **1. Comet tails 2. Comet Arend-Roland.**—*Author's abstract.* Ⓢ

11L–212 523.6

Nazarchuk, G. K. (*Kiev State Univ.*), **Accelerations in the tail of the comet 1956h (Arend-Roland).** *Soviet Astronomy AJ*, New York, 3(4):698–701, Jan./Feb. **1960.** fig., 2 tables, 5 refs. **DLC.** Transl. of **Uskoreniia v khvoste komety 1956h (Arenda-Rolana),** *Astronomicheskiĭ Zhurnal*, Moscow, 36(4):719–722, July/Aug. **1959. DLC**—The accelerations have been determined from the motion of cloud formations and nonuniformities in the tail of the comet 1956h. It was established that on April 27th and 30th and May 2nd, 1957, repulsive forces of the order of 850–2500 units of solar attraction acted on particles in the tail of the comet. The particle velocities in the tail increased with the radius vector. The accelerations due to the repulsive force increased at first and then decreased with increasing radius vector of the particles. Large particle accelerations in the comet's tail may have been due to the effect of a corpuscular stream escaping from a prominence. The identification of the prominence with the position of the comet was made by projecting the comet onto the solar disc. *Subject Headings:* **1. Comet tails 2. Comet Arend-Roland.**—*Author's abstract.* Ⓢ

11L–213 523.67

Stawikowski, A. and Swings, P. (*both, Institut d'Astrophysique de l'Université de Liège*), **Mécanisme d'excitation des bandes de Swan des comètes.** [The excitation mechanism of the Swan bands of comets.] *Annales d'Astrophysique*, Paris, 23(4):585–593, July/Aug. **1960.** 3 tables, 17 refs. French, English and Russian summaries p. 585. **DWB, DLC**—The high resolution spectrograms of Comet Mrkos (1957d) reveal the essential features of the rotational structure of the Swan-bands. Intensity anomalies observed within the (1–0) and (2–1) transitions are due to the presence of absorption lines in the exciting solar radiation. It is thus proved that the Swan bands are excited by fluorescence, although their lower level $3\pi_u$ is not the ground electronic state of C_2. *Subject Headings:* **1. Comet Mrkos (1957d) 2. Comet spectra 3. Rotational structure of Swan bands.**—*Authors' abstract.* Ⓢ

11L–214 523.64:521.732

Arend, S., **La comète Arend, deuxième comète périodique belge réobservée à son retour.** [The Arend comet, second Belgian periodic comet observed on its reappearance.] *Ciel et Terre*, Brussels, 75(11/12):337–341, Nov./Dec. **1959.** 2 figs. **DWB, DLC**—This Comet was discovered by the author and was named after him in 1951. It was photographed for the first time from the Royal Observatory of Belgium on Oct. 4, 1951 by means of the 40 cm double-astrograph. Larger instruments such as the Mount Wilson telescope and that of the Mcdonald Observatory, supplied more accurate photos and enabled the author to follow the comet during the 207-day period. These observations made it possible to calculate the orbit of the comet which belongs to the Jupiter family and revolves round the Sun in 7 years and 9 months. The comet was rediscovered on July 6, 1959 by ELIZABETH ROEMER by means of the telescope of the Naval Observatory at Washington. The Arend Comet (1951 j) has thus a clearly established periodicity and is definitively named 1951 X. Its orbital elements as found by various authors are given and one mentions the other comets discovered by Belgian astronomers. *Subject Headings:* **1. Periodic comets 2. Comet Arend-Roland.**—*A.V.* Ⓢ

11L–215 523.64

Shteĭns, K. A. (*Latvian State Univ.*), **The distribution of the Jovian group of comets, Pt. 2, The spatial problem.** *Soviet Astronomy AJ*, New York, 3(3):499–509, Dec. **1959.** 4 figs., 6 refs., 52 eqs. **DLC.** Transl. of **Raspredelenie komet gruppy Iupitera. Chast' II. Prostranstvennaia zadacha,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(3):512–523, May/June **1959. DLC**—The formula determining the distribution functions of the major axes a, the parameters p and the inclinations i of the orbital planes have been derived for short-period comets in two different variants. In the so-called hydrodynamic variant a continuous stream of comets was considered. This method was

applied by H. A. NEWTON. The reason for the unsatisfactory agreement of NEWTON'S results with observations is given. In the second variant which was used by FESENKOV, the individual properties of the cometary orbits are taken into account during capture. For long-period comets it is assumed that the poles of the orbits, the ascending nodes and the distances of the perihelions from the ascending nodes are distributed uniformly in space. The disintegration of comets and the probability of detection of short-period comets (determined empirically) are also taken into account. The results are in good agreement with observations. In both cases three main properties of the distributions were found: 1) a decrease in the number of comets with increasing values of the major axes, 2) a concentration of comets for a given value of a, p having the maximum possible value, 3) the absence of comets with retrograde motions and the concentration of almost all of the comets in the interval of i from 0° to 25°. *Subject Heading:* **1. Comets.**—*Author's abstract.* Ⓢ

11L–216 551.521.67:523.66:523.037.5

Cherednichenko, V. I. (*Kiev State Univ.*), **The dissociation and ionization of cometary molecules in the photon and corpuscular field of solar radiation.** *Soviet Astronomy AJ*, New York, 3(2):254–262, March/April **1959.** 8 figs., 30 refs., 7 eqs. **DLC.** Transl. of **Dissotsiatsiia i ionizatsiia kometarnykh molekul v pole fotonnoĭ i korpuskuliarnoĭ radiatsii Solntsa,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(2):254–263, March/April **1959. DLC**—The role played by photon and corpuscular solar radiation in the dissociation and ionization of cometary molecules is elucidated. On the basis of present data on the concentration and velocity of solar corpuscles and the intensity of photon solar radiation (from observations with rockets, artificial earth satellites and other methods) and using the empirical relations deduced by the author for calculating the effective cross sections of ionization, dissociation and recharge of cometary molecules and atoms during collisions with solar protons, the lifetime of the assumed parent cometary molecules (H_2O, CH_4, CO_2, NH_3, C_2N_2, C_3H_6, C_2H_2 N_2, O_2, H_2) and observed cometary molecules and radicals (C_2, CH, N_2^+, CO_2^+, C_3, CO^+, OH, OH^+, CH, CH^+, NH, NH_2) were calculated. These calculations were made for various processes of transformation of these molecules in the photon and corpuscular field of solar radiation. Of all the possible processes of transformation of parent molecules (more than 500) the most probable were selected and are given in the form of corresponding transformation schemes of cometary molecules. The lifetimes τ of cometary molecules were derived for the distance of the comet to the sun $r=1$ AU. A good agreement of the calculated r with observational data is noted. On the basis of the derived lifetimes of cometary molecules, the variation of the diameter of the head of Halley's comet 1910 II in C_2IV emission was found for $0.6 \leq r \leq 2$, 3 AU, the results being in good agreement with observations. *Subject Headings:* **1. Corpuscular emissions from sun 2. Comets 3. Solar photons.**—*Author's abstract.* Ⓢ

11L–217 523.67:535.33

Grudzinska, S., **L'abondance des molécules CN, C_2 et CO^+ et des particules solides dans les comètes.** [The abundance of CN, C_2 and CO^+ molecules and of solid particles in comets.] *Ciel et Terre*, Brussels, 76(5/6):173–176, May/June **1960.** 10 refs. **DWB, DLC**—Study relating to the chemical composition of comets based on photoelectric and spectroscopic observations. The author is of the opinion that the abundance of molecules responsible for the emission spectra in various comets is: for CN and C_2 in the range of 0.1 to 100 molecules per cm^2; for CO^+ in the range of 1 to 100 molecules per cm^2. The total mass of dusts should be confined between the limits of 10^7 gr and 10^{12} gr, the average densities ranging about 10^{-19} to 10^{-24} gr/cm^2. *Subject Headings:* **1. Chemical composition of comets 2. Comet spectra 3. Cometary dust.**—*A.V.* Ⓢ

11L–218 523.673

Vsekhsviatskiĭ, S. K. (*Kiev State Univ.*), **On the nature of "synchronic" formations in comet's tails.** *Soviet Astronomy AJ*, New York, 3(3):490–498, Dec. **1959.** 5 figs., 4 tables, 13 refs. **DLC.** Transl. of **O prirode "sinkhronnykh" obrazovaniĭ v khvostakh komet,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(3):503–511, May/June **1959. DLC**—It is shown that the bands observed in the tails of some bright comets (1744, 1858 VI, 1910 I, and others), termed "synchrones" by BREDIKHIN, could not have been formed by simultaneous ejections of dust particles from the nucleus of the comet. The following provide evidence against the concept of synchrones adopted to the present time: 1) the short lifetime of the bands: 2) the regular sequence of bands in tails; 3) the disagreement between the directions of the bands and the theoretical directions obtained from the mechanical theory; 4) the doublet structure of the bands. The system of bands observed in the type II tail of the comet 1957d Mrkos was studied. A rapid variation of the bands was found, which cannot be explained from the point of view of the mechanical theory, there being a marked discrepancy between their directions and those of the theoretical synchrones. On the basis of a close similarity between the structure and other features of the "synchrones" in comets and rays of the polar solar corona, a conjecture is made on the electromagnetic nature of these formations. "Synchrones" may be the

manifestation of the magnetic field of the solar system or frozen-in lines of force carried by corpuscular streams. It is shown that the magnetic field strength in the tail of the Mrkos comet could have been less by a factor of ten than that of the solar corona. It is noted that many structural features in type I tails and in particular ray systems in comets, can be explained only as the result of electromagnetic processes taking place in cometary plasma. *Subject Heading:* **1. Comet tails.**—*Author's abstract.* Ⓢ

THE SUN

GENERAL

See: **Visual stellar magnitude of Sun** (Martinov), 11L–48; **Differential photometer for solar magnetograph** (Kotliar), 11L–51; **Tidal accelerations due to Sun** (Longman), 11L–63; **Solar observations at Roy. Obs. of Belgium during IGY** (Koeckelenbergh), 11L–86; **Radio waves from the Sun,** 11L–87 to 11L–102; **Radar echoes from the Sun** (Eshleman et al.), 11L–120; **Dissociation and ionization of cometary molecules in photon and corpuscular field of solar radiation** (Cherednichenko), 11L–216.

PHOTOSPHERE, LIMB, CENTER, GRANULATION

See also: **Faculae bordering small sunspots near the limb** (Loughead, Bray), 11L–250; **Granulation in sunspot umbrae** (Loughhead, Bray), 11L–251; **Center-limb variation of solar X radiation** (Tamburini, Thiessen), 11L–257; **Sightline velocities in disk and limb phenomena** (Reid), 11L–279.

11L–219 523.741 :778.3

Rösch, Jean (*Obs., Pic du Midi*), **Observations sur la photosphère solaire, I, Technique des observations photographiques (objectif de 23 cm).** [Observation of the Sun's photosphere, Pt. 1, Photographic observation techniques (23 cm objective).] *Annales d'Astrophysique*, Paris, 22(5): 571–583, Sept./Oct. **1959.** fig., table, 10 refs. English and Russian summaries p. 571. **Pt. 2, Numération et photométrie photographique des granules dans le domaine spectral 5900–6000 A.** [Counts and photographic photometry of granules in the spectral region 5900–6000 Å.] *Ibid.*, p. 584–607. figs., table, 9 refs. English and Russ. summaries p. 584–585. **DWB, DLC**—The first paper reports on a long series of observations performed at the Pic du Midi Observatory, in the hope that a large amount of data, and some technical care, would yield valuable results. Description is given of the instrument (23 cm refractor, narrow spectral range around 5950 Å), of the care taken to avoid, as far as possible, the effects of atmospheric turbulence (focal plane cooling, operating rules), of the exposure technique (24 frames per sec during a few sec, every 30 or 60 sec) and of the various types of documents obtained (granules and sunspots). The second paper contains results of the measurements, namely: 1) counts of granules on composite pictures. The total number of granules on the photosphere, taking into account the fainter ones, is found to be about $3.5 \cdot 10^6$. 2) Estimate of the mean distance between centers of granules (2″0) considered as more significant than the ill-defined "diameter." 3) Estimate, from one microphotometer tracing, of the r.m.s. in brightness (3.5%). 4) Drawing of an isophotal map, which shows the bright regions predominant over the dark ones. 5) Tracing of mean profiles of granules and porules (dark regions of granular size) and estimate of the mean relative difference of brightness (11.7%). 6) Correction for diffraction, leading to a brightness of granules in excess of 23% (mean value) over the background. *Subject Headings:* **1. Photosphere 2. Solar photography 3. Solar granulation.**—*Author's abstracts.* Ⓢ

11L–220 523.741 :523.042

†Pecker, Jean-Claude and Vogel, Lise, (*both, Observatoire de Paris-Meudon*), **Ecarts à l'équilibre et abondances dans les photosphères solaire et stellaires, II, Les cas des atomes neutres de titane, vanadium, chrome dans l'atmosphère solaire.** [Departures from equilibrium and abundances in the solar and stellar photospheres, Pt. 2., The cases of the neutral atoms of titanium, vanadium and chromium in the solar atmosphere.] *Annales d'Astrophysique*, Paris, 23(4):594–621, July/Aug. **1960.** 9 figs., 2 tables, 28 refs. French, English and Russian summaries p. 594. **DWB, DLC**—The very different behavior, at the same depths in the solar photosphere, of equal excitation lines of equal ionization potential atoms (Ti, V, Cr) is the proof of the fact that the non L T E effects are, for the considered atoms and layers, more important than the effect of inhomogeneities. Moreover, it is not the choice of the model that is responsible for the observed phenomena. *Subject Headings:* **1. Solar atmosphere 2. Photosphere.**—*Authors' abstract.* Ⓢ

11L–221 523.741:523.036.515

Praderie, Francoise-Eugène, and Pecker, J.-C. (*Ecole Normale Supérieure de jeunes filles de Sèvres et Observatoire de Meudon*), **Ecarts à l'équilibre et abondances dans les photosphères solaire et stellaires, III, Ecarts à l'ETL dans la bande CH 4300 (cas solaire).** [Departures from equilibrium and abundances in the solar and stellar photospheres. Pt. 3, Departures from the local thermodynamic equilibrium in the 4300 Å band of CH (solar case).] *Annales d'Astrophysique*, Paris, 23(4):622–632, July/Aug. **1960.** 5 figs., 5 tables, 16 refs. French, English and Russian summaries p. 622. **DWB, DLC**—The method described in the previous articles of the present series (designated N E T L I and N E T L II) is applied to the case of the 4300 Å band of CH. Large departures from local thermodynamic equilibrium are found; the excitation temperatures are about 300° higher than the electron temperatures. However the values found by the authors are "not entirely incompatible" with classical determinations of the rotation temperatures. Moreover, the present calculations allow a correct interpretation of limb-darkening observations. *Subject Headings:* **1. Solar atmosphere 2. Photosphere 3. Chromosphere 4. Ionization temperature.**—*Authors' abstract.* Ⓢ

11L–222 523.741:523.036.515

Rountree, Janet C. (*Observatoire de Meudon*), **Ecarts à l'équilibre et abondances dans les photospheres solaire et stellaires, IV, Le cas du titane ionisé.** [Departures from equilibrium and abundances in the solar and stellar photospheres, Pt. 4, The case of ionized titanium.] *Annales d'Astrophysique*, Paris, 23(4):633–654, July/Aug. **1960.** 11 figs., 4 tables, 14 refs. French, English and Russian summaries p. 633. **DWB, DLC**—New oscillator strengths are calculated for a number of lines of TiII. The departures from local thermodynamic equilibrium for multiplets of this ion, that is, the difference between the excitation temperatures of the lines and the electron temperature in the solar layers in which they are formed, are determined by two methods, using curves of growth and central intensities. The results of these calculations, although very approximate, are in agreement with the ideas of THOMAS. *Subject Headings:* **1. Photosphere 2. Solar atmosphere 3. Ionization temperature.**—*Author's abstract.* Ⓢ

11L–223 523.741:523.746

Miller, R. A., **Observations on photospheric brightness surrounding sunspots.** *British Astronomical Association, Journal*, 70(3):146–147, March **1960.** fig., photograph. **DWB, DLC**—A film of the sun with a 4 inch refractor shows the phenomenon of bright ring which sometimes encircles large sunspots. An enlargement was examined section by section to investigate the phenomenon. The figure shows the granule count in squares into which enlargement was divided. The foculer area about the spots is shown by a double dashed line. The brightness was seen due to a milky white background. *Subject Headings:* **1. Sunspot structure 2. Photosphere.**—*A.H.K.* Ⓢ

11L–224 523.741/2

Teplitskaia, R. B. (*I. I. Mechnikov Astron. Obs., Odessa State Univ.*), **Comparison of the curves of growth for the center and the limb of the solar disc.** *Soviet Astronomy AJ*, New York, 4(1):49–59, July/Aug. **1960.** 10 figs., 3 tables, 24 refs., 7 eqs. **DLC.** Transl. of **Sravnenie krivykh rosta v tsentre i na kraiu solnechnogo diska,** *Astronomicheskiĭ Zhurnal*, Moscow, 37(1):51–62, Jan./Feb. **1960. DLC**—The variation of the equivalent widths of FeI and TkK toward the solar limb is studied by means of the curves of growth. The theoretical curves of growth for the solar center and the limb were computed using two models of the photosphere; Vitense II and Voigt, and de Jager VII. It was found that the first of these two models is in better agreement with observations. A small increase in the turbulence velocity toward the outer layers of the solar atmosphere was detected. The existence of the parity effect in the broadening of spectral lines is confirmed. *Subject Headings:* **1. Solar phenomena 2. Photosphere.**—*Author's abstract.* Ⓢ

11L–225 523.741/2

Böhm, Karl-Heinz and Böhm-Vitense, Erika (*both, Univ. Kiel*), **Zur interpretation des Intensitätsabfalls am äussersten Sonnenrand.** [Interpretation of the intensity drop at the outer edge of the Sun.] *Zeitschrift für Astrophysik*, Berlin, 50(1):69–72, **1960.** fig., 9 refs., 5 eqs. English summary p. 69. **DLC**—Recent measurements of the solar limb intensity profile by ROGERSON (1959), using a balloon-borne telescope, are compared with the intensity distributions computed for a model including blanketing effect (BOHM 1954) and for DE JAGER'S model V (1952) without this effect. Because the H^--continuum is formed in local thermodynamic equilibrium (PAGEL, 1959), we can get information about the kinetic temperatures in the high photosphere by this comparison. We conclude that the influence of the blanketing effect on the temperature stratification of the upper photosphere is considerable, but not as large as in a model atmosphere, where the lines are formed in local thermodynamic equilibrium. *Subject Headings:* **1. Solar limb intensities 2. Photosphere.** —*Authors' abstract.* Ⓢ

SOLAR ACTIVITY

See also **Solar radio emission and polar cap absorption of cosmic noise** (Kundu, Haddock), 11L–102; **Circulatory nature of 11 year cycle of solar activity** (Chistiakov), 11L–242; **Solar activity in 1958** (Cragg), 11L–243; **Solar activity before 1750** (Gleissberg), 11L 244; **Sunspots during 18th activity cycle** (Künzel), 11L–246; **Solar activity in 1958** (Koeckelenbergh), 11L–249; **Periodicity of solar activity** (Ol'), 11L–254; **E-W asymmetry of spot formation activity** (Romanchuk, Kudinova), 11L–255; **Recurrent geomagnetic storms and solar prominences** (Bednářova-Nováková), 11L–281; **Sudden disappearance of filaments and magnetic storms** (Dizer), 11L–282; **Monochromatic corona in 11-year cycle** (Waldmeier) 11L–300.

11L–226 523.745:538.12:778.34

Babcock, Horace W., **The magnetism of the sun.** *Scientific American*, N. Y., 202(2):52–62, Feb. **1960**, 12 figs. **DWB, DLC**—Photographic representations of the sun are given to illustrate the solar light of different wavelengths and the magnetic fields at its surface. The significance of the latter characteristic is used in explaining the problem of Zeeman effect. Means whereby the wave lengths in the spectrum 3900 to 7500 Å can be distinguished and separated are analyzed. Several photographs of the spectrum, the polaroidal field and the bipolar magnetic, unipolar magnetic and toroidal magnetic fields of the sun are presented. In the bipolar region there are prominences of relatively cool hydrogen gas. This has been observed high above the surface and is considered to owe its existence to the magnetic fields that are found above the bipolar region. Details of many other characteristics are given. *Subject Headings:* **1. Solar magnetism 2. Solar photography.** —*N.N.* Ⓢ

11L–227 523.745:551.510.535

Bugoslavskaia, N. Ia., **Solnechnaia aktivnost' i ee vliianie na ionosferu.** [Solar activity and its effect on the ionosphere.] Moscow, Gosud. Izdat-vo Literatury po Voprosam Sviazi i Radio, **1959.** 31 p. 7 figs. **DLC** (QC879.B79)—Basic information on the composition of solar radiation is outlined in connection with the radiation of the active sun regions and with the ionospheric-magnetic disturbances affecting the degree of stability of work of radio communications. The propagation of short radio waves, reflected from the ionosphere is discussed in relation to various disturbances occurred in the ionized layer of the atmosphere, which are differently affected at different geographic latitudes. For example, disturbances observed in the Arctic are not observed in the middle latitudes. The discussion concerns two different problems: 1) analysis of the conditions of illumination of the atmosphere in relation to the geographic latitudes, and the energy of solar radiation changing periodically (daily and seasonally); 2) special consideration is given to the processes in separate regions of the sun, which affect the nonregular solar radiation and produce the disturbing actions in the earth atmosphere. The ionospheric magnetic disturbances are connected with the processes of modification of propagation of the short radio waves. The two problems are discussed in detail and illustrated. The disturbances of two types are discussed: of the ultraviolet nature (occurring mainly in the daytime) and of the corpuscular or ionospheric-magnetic nature. Periodicity of the solar phenomena with the eleven year cycle is explained with details and graphic illustration. The short wave radio communication of different frequencies is locally affected by the ionospheric disturbances in different ways. By taking account of these variations the frequencies can be changed for particular periods of disturbance. The methods of selection of suitable frequency are explained. *Subject Heading:* **1. Solar ionospheric relationships.**—*N.P.S.* Ⓢ

11L–228 551.521.64:523.745

Ehmert, A.; Erbe, H.; Pfotzer, G. et al. **Observations of solar flare radiation and modulation effects at balloon altitudes, July 1959.** *Journal of Geophysical Research*, Wash., D. C., 65(9): 2685–2694, Sept. **1960.** 8 figs., 19 refs. **DLC**—Observations of cosmic ray time variations in the stratosphere were obtained over Berkeley, Calif. (U. S.), and Lindau/Harz (Germany) during the period of outstanding solar activity in July 1959. Whereas over Berkeley (geomag. latitude 44°N) only modulation of cosmic radiation by solar controlled processes was observed, additional radiation accelerated in the vicinity of the sun (approximately 46% above normal) was observed over Lindau (geomag. latitude 52°N) on July 15. On the assumption that the excess radiation consisted almost entirely of protons, its energy spectrum had the form $N(E)dE \sim E^{-4}\,dE$ and extended up to 400 Mev. According to conventional geomagnetic theory, individual protons of these energies are normally forbidden at geomagnetic latitude 52°N. Their presence over Lindau on July 15 indicates that they were admitted by some mechanism which temporarily lowers the cutoff rigidity at this latitude during a magnetic storm. There is also some indication of further examples of excess radiation over Lindau at atmospheric depths down to 30 mm Hg on July 13, 21, 23, and 31. *Subject Headings:*

1. Cosmic ray time variations 2. Solar flare emissions. I. Anger, C. D. II. Brown, R. R.—*Authors' abstract.* Ⓢ

11L–229 551.521.64:550.385.43:523.745

Gold, T. (*Harvard College Obs., Cambridge, Mass.*), **Magnetic field in the solar system.** *Nuovo Cimento, Bologna*, Supplement No. 1 to Ser. 10, Vol. 13, **1959.** p. 318–323. Eqs. **DLC**—The difficulty of approaching the magnitude of the product (conductivity) X (linear dimensions) in laboratory experiments make it necessary to analyze the magnetic field by considering the chromosphere, the corona and changes in configuration of the magnetic field in the space between the sun and the earth. Based on information from the large increase in cosmic ray flux associated with the solar flare of Feb. 23, 1956, a magnetic field is supposed to form a closed system for the particles. Particles originally stored in the flare expand and may form an outburst. Discussing the magnetic storm, its sudden commencement is noted as an argument for the existence of interplanetary fields. Strong currents near the earth's surface are indicated. "Excited cases" of disturbances may correspond to a reduction of field strength only. VAN ALLEN'S observations on auroras indicate an incoming flux in association with the part of the sun's magnetic field associated with the particles. This is in accord with a phenomenon as detected by VAN ALLEN by means of the Explorer satellites. *Subject Headings:* 1. **Sun's magnetic field** 2. **Solar flare effects on cosmic rays.**—*O.T.* Ⓢ

11L–230 538.69:523.745

Kiepenheuer, K. O. (*Fraunhofer Inst., Freiburg i. Br.*), **The observability of hydromagnetic phenomena on the sun.** *Nuovo Cimento, Bologna*, Supplement No. 1 to Ser. 10, Vol. 13, **1959.** p. 305–310. 4 figs., 3 refs., eqs. **DLC**—The accuracy of observations and their limitations by the atmosphere as influenced by the magnetic field is examined. The fibrous structure of the sun's atmosphere make temperature and density measurements necessary for each layer and the disturbances of seeing conditions have to be taken into consideration. The analysis of measurements of the magnetic field show that all results are smoothing out the fine details. Limitations of observations are reviewed on photospheric granulation; sunspots, chromospheric structures, prominences, filaments and corona. Observations of hydromagnetic phenomena on the sun are quite insufficient for theoretical work yet. Photographs illustrate the chromospheric structure, its visibility and the ejection of chromospheric matter. *Subject Headings:* 1. **Hydromagnetic waves** 2. **Solar atmosphere.** —*O.T.* Ⓢ

11L–231 551.521.67:523.745

Kolpakov, P. E., **On the generation of corpuscular streams by the magnetic fields of sunspots.** *Soviet Astronomy AJ*, New York, 3(1):69–75, Jan./Feb. **1959.** 2 figs., 10 refs., 20 eqs. **DLC.** Transl. of **O generirovanii korpuskuliarnykh potokov magnitnym polem solnechnykh piaten,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(1):65–72, Jan./Feb. **1959. DLC**—The paper considers the possibility of the generation of corpuscular streams in a nonuniform magnetic field, increasing in intensity with time, associated with a unipolar group of sunspots. The fastest particles of the coronal-chromospheric plasma, which belong to the "tail" of the Maxwell distribution, and for which the condition $eE_{\perp}^{\text{ind}} \geqslant F_{\text{ret}}$ is satisfied, will gain energy due to the action of the induced electric field, according to the relation $W_{\perp} = W_{01}(H/H_0) \sim 6 \cdot 10^3$ to $4 \cdot 10^5$ ev. These particles will rise because of the nonuniformity of the magnetic field, and their energy $W_{\perp}$ will be converted into energy $W_{\parallel}$ of motion in the direction of the magnetic lines of force associated with the spot. Particles having energies $W_{\parallel} \sim 6 \cdot 10^3$ to $4 \cdot 10^5$ ev in the region of the outer corona may escape from the sun and form corpuscular streams. *Subject Headings:* 1. **Corpuscular radiation** 2. **Sunspot magnetism.**—*Author's abstract.* Ⓢ

11L–232 523.745:535.33

Kornilov, A. I. (*P. K. Shternberg State Astronomical Inst.*), **Effect of sunspot magnetic fields on the growth curve.** *Soviet Astronomy AJ*, New York, 4(1):174–176, July/Aug. **1960.** 2 figs., 12 refs, eq. **DLC.** Transl. of **O vliianii magnitnykh poleĭ solnechnykh piaten na krivuiu rosta,** *Astronomicheskiĭ Zhurnal*, Moscow, 37(1):182–184, Jan./Feb. **1960. DLC**—Growth curves based on the VI and FeI lines were plotted for the large sunspot of July 14, 1953. The measured Doppler velocity of 1.75 km/sec was larger than the corresponding value for the thermal velocity. This increase in velocity is apparently due to fine-scale turbulence, since no correlation between increased equivalent line widths and splitting of lines in the magnetic field was evinced. *Subject Heading:* 1. **Sunspot magnetism.**—*Author's abstract.* Ⓢ

11L–233 523.745:550.385.4

Laurie, P. S. and Finch, H. F., **Solar activity and geomagnetic storms, 1959.** *Observatory*, London, 80(915):78–80, April **1960.** 3 tables. **DLC** (QB1.02)—Solar activity showed more positive

gns of declining during the year, although the mean level remained higher than at the peak of any her cycle. The maximum of the current cycle occurred at 1957.9. There was considerable iono- pheric activity during the first half of the year. The total number of storms for the year was only ightly less than 1958. Tables are given of: 1) provisional Zurich mean daily sunspot numbers,) details of the geomagnetic storms and 3) details of the more striking sudden commencements of eomagnetic activity. *Subject Headings:* **1. Sunspots 2. Geomagnetic storms 3. Solar-geomag- etic relationships.**—*R.B.* Ⓢ

11L–234 551.521.67:523.745:550.385

Mustel', E. R. and Mitropol'skaia, O. N. (*Astron. Coun., Acad. Sci., U.S.S.R.*), **The velocity pectrum of corpuscles in solar corpuscular streams.** *Soviet Astronomy AJ*, New York, 3(1):5–21, an./Feb. **1959.** 2 figs., 19 refs. **DLC.** Transl. of **O spektre skorosteĭ korpuskul v korpuskuli- rnykh potokakh iz Solntsa,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(1):5–16, Jan./Feb. **1959. DLC**— he velocity spectrum of corpuscles ejected from plages was studied for the period 1951–1953. arlier correlations between plages and geomagnetic activity have been revised. The plages on the ynoptic maps of this paper have been plotted for the day of their passage through the central eridian. It is shown that the passage of plages across the visible center of the solar disc (or near it) xplains not only the rise of the disturbances but also the following two effects: a) the rise and dis- ppearance of entire geomagnetic sequences upon the appearance of new plages or the disappearance f old plages, respectively; b) the rise, disappearance, intensification, and weakening of geomagnetic equences during the change in sign of the heliographic latitude B_0 of the disc's center. Pertinent xplanations are given in the text under numbers referring to the synoptic maps. Disturbances $_6$–I_8 are connected with unipolar magnetic regions. These regions could not have created the $_4$–K_6 disturbances, because the intensity of the K disturbances was increasing at that time. For ach plage (with the exception of the most uncertain cases), the authors determined v_1, the velocity f the fastest corpuscles, and v_2, the velocity of the slowest corpuscles. In this way, the total velocity ange v_1–v_2 was determined. It was also assumed that the velocity spectrum of corpuscles ejected om every point of a given plage is the same. The results of the determinations of v_1–v_2 was deter- ined. The results of the determinations of v_1 and v_2 are plotted. The following conclusions may e drawn; a) the dispersion of v_1 is small. b) The total velocity range Δv for different streams is latively small, of the order of 200 km/sec on the average, and in many cases extremely long. This a result of the small velocities of the corpuscles before minimum activity. The derived values of v are substantially smaller than the velocity dispersion which one would expect from a study of $H\alpha$ emission profiles in the spectra of aurorae. In connection with this it is pointed out that, evi- ently the protons exciting the $H\alpha$ line in auroral spectra are not directly connected with those aseous condensations which cause geomagnetic disturbances. Apparently, the energy of the ondensations mentioned is mainly the energy of the frozen-in magnetic field, while the energy of the rotons responsible for the $H\alpha$ line is their kinetic energy. The absence of a close connection between eomagnetic disturbances and $H\alpha$ emission in aurorae also affirms this conclusion. Those facts hich attest to the correctness of the relationship between plages and geomagnetic disturbances are ummarized at the end of the paper. *Subject Headings:* **1. Corpuscular emissions from sun 2. Veloc- y spectra 3. Geomagnetic disturbances 4. Solar-geomagnetic relationships.**—*From authors' bstract.* Ⓢ

11L–235 550.385:523.745

Mitropol'skaia, O. N. (*Astro. Obs., Simeis, Crimea*), **Some results of statistical treatment of eomagnetic disturbances of the declining branch of solar activity.** *Soviet Astronomy AJ*, New York, (2):228–234, March/April **1959.** 6 figs., 13 refs. **DLC.** Transl. of **Nekotorye rezul'taty statis- cheskoĭ obrabotki geomagnitnykh vozmushcheniĭ na niskhodiaschheĭ vetvi solnechnoĭ aktivnosti,** *stronomicheskiĭ Zhurnal*, Moscow, 36(2):224–232, March/April **1959. DLC**—The present paper eals with statistical investigations based upon already established connections between flocculi and eomagnetic activity. These connections were traced for the following periods of declining branch f the solar activity: **1929–1933; 1942–1944,** and **1951–1953.** The basis for the above mentioned orrelations was the fact that crossing by practically every flocculus of the visible center of the solar isk (or near it) is accompanied by geomagnetic disturbances. The second part of the study deals ith the application of the statistical superposed-epoch method to the flocculi and geomagnetic isturbances. The results which one should expect from the application of this method to the henomena of flocculi and geomagnetic disturbances are discussed. *Subject Headings:* **1. Solar- eomagnetic relationships 2. Geomagnetic disturbances.**—*E.K.* Ⓢ

11L–236 523.745

Severnyĭ, A. B. (*Crimean Astrophys. Observ.*), **Fine structure of the magnetic field and depolari- ation of radiation in sunspots.** *Soviet Astronomy AJ*, New York, 3(2):214–220, March/April **1959.**

3 figs., table, 11 refs., 7 eqs. **DLC.** Transl. of **Tonkaia struktura magnitnogo polia i depoliarizatsi izlucheniia v solnechnykh piatnakh,** *Astronomicheskiĭ Zhurnal,* Moscow, 36(2):208–214, March/Ap **1959. DLC**—Photoelectric tracings of the magnetic fields of sunspots, made with the aid of a sol magnetograph at high (≈1″) resolution, show the fine-scale structure of the field with its characterist dimensions in several seconds of arc. The disappearance of the transverse field on the magnetogra and the appearance of the triplet in the umbrae may be explained by depolarization of the radiati caused by fluctuations in the field leading to fluctuations in the magnetic rotation of the plane polarization. Collisions with hydrogen atoms also fulfill an important role in the depolarizati of the Zeeman pattern in sunspot umbrae. Direct observations confirm the depolarization of t radiation in the umbrae, demonstrating the lack of sensitivity of the Zeeman pattern to differe orientations of the polarizing optics. The existence of a transverse field component in the penumb and several other phenomena (vortical structure around spots, intermittent appearance of clos neutral lines around unipolar spots) point to the possibility of an azimuthal field component appeari in spots, which would make the field of the spot similar to force-free fields (with lines of force executi a spiral). *Subject Heading:* **1. Sunspot magnetism.**—*Author's abstract.* Ⓢ

11L–237 523.74:550.3:061

*Trotter, Dorothy E. and Roberts, Walter Orr, **Solar activity summary III, June 15–Oct. 2, 196** *Colorado. Univ. High Altitude Observatory, Report HAO-49,* Sept. 1, **1960.** 27 p. 2 figs., tabl "Prepared for the IGY." **DWB** (523.74 C719r)—This is a solar activity summary for the peri 15 June through 2 Oct. 1959. It was prepared by the High Altitude Observatory of the Universi of Colorado. Twelve different regions with different longitudes and latitudes are dealt with. T data includes time, place and area of the different sun flares. Tables are given showing coron observations from Colorado and New Mexico during the period July–October. Many charts a included. *Subject Headings:* **1. Solar activity data 2. IGY solar activity program.**—*A.H.K.* Ⓢ

11L–238 523.7

Waldmeier, M. (*Eidgen. Sternwarte, Zürich*), **Zirkulation und Magnetfeld der solaren Polarzon** [Circulation and magnetic field of the sun's polar region.] *Zeitschrift für Astrophysik,* Berl 49(3):176–185, **1960.** 7 figs., 10 refs. English summary p. 176. **DLC**—On the N hemisphere t polar magnetic field reversed about a year later than on the S hemisphere, which is in connecti with the spot-maximum having occurred about one year later on the Northern than on the Southe Hemisphere. The reversal of the magnetic field takes place when the polar coronal zone reaches t pole, i.e. when the corona shows its typical maximum shape, when the polar prominence zone is in t latitude of $b = 68°$. As the magnetic measurements refer to latitude $b = 50°$ to 80°, we consider t polar prominence zone as separation between opposite polarities. This conclusion is supported the arch-shaped structures of the corona over prominences and by magnetograms from the perio when the field is reversed. Applying these reflections to the spot-region, we find that the ma prominence zone is another separation between fields of opposite polarities. Considering that t coronal intensity shows minima in the prominence zones, these are separating also different regio of coronal emissions. Thus the magnetic zones seem to be in a close connection with the coron emission regions. *Subject Headings:* **1. Solar magnetism 2. Solar activity.**—*Author's abstract.* Ⓢ

SUNSPOTS

See also: **Visibility of 10-cm radio-emissive region** (Covington, Harvey), 11L–87; **Solar radioelectric storm sources and associated optical activity centers** (Blum, Malinge), 11L–92; **Solar radio bursts at sunspot maximum** (Maxwell et al.), 11L–93; **Polarization in solar radioelectric storms** (Malinge), 11L–98; **Photospheric brightness surrounding sunspots** (Miller), 11L–223; **Generation of corpuscular streams by magnetic fields of sunspots** (Kolpakov), 11L–231; **Effect of sunspot magnetic fields on the growth curve** (Kornilov), 11L–232; **Fine structure of magnetic field and depolarization of radiation in sunspots** (Severnyĭ), 11L–236.

11L–239 523.7

Baxter, W. M., **Sunspots and the "Wilson effect."** *British Astronomical Association, Journ* 70(3):138–142, March **1960.** 3 figs., plates. **DWB, DLC**—Sunspots are usually associated wi cyclones on the surface of the sun. In 1769 Dr. Wilson of Glasgow made a close study of a lar naked eye spot near the west limb of the sun. According to him the spot was a vast cavity wi umbra at the bottom and penumbra forming sloping sides. Mendel has described the spot as depression in the solar surface. Still the real nature of sunspots is to be discovered. *Subject Headi* **1. Sunspot theories.**—*A.H.K.* Ⓢ

11L–240 523.746

Bell, Barbara (*Harvard College Obs., Cambridge, Mass.*) and Glazer, Harold (*Raytheon Maynard Lab., Maynard, Mass.*) **Some sunspot and flare statistics.** *Smithsonian Contributions to Astrophysics*, Wash., D. C., 3(4):25–38, **1959.** 17 tables, 19 refs. **DWB, DLC**—This paper presents some statistics on 5940 sunspot groups observed at the Mount Wilson Observatory during the years 1937 through 1953. The principal topics studied are: the frequency of spot groups occurring in the various Mount Wilson magnetic classes, and the dependence of this frequency on the size and age of the spot groups; some aspects of the apparent east-west asymmetry in spot distribution on the solar disc; and the distribution of 8403 observed solar flares among spot groups of various magnetic classes, sizes, and ages. *Subject Headings:* **1. Sunspot data 2. Solar flares.**—*Authors' abstract.* Ⓢ

11L–241 523.746

Bell, Barbara, **On the structure of the sunspot zone.** *Smithsonian Contributions to Astrophysics*, Wash., D. C., 5(3):17–28, **1960.** 15 figs., 10 refs. **DLC**—According to CARRINGTON the distribution of sunspots shifts in latitude. MAUNDER's (1904, 1913) famous butterfly diagram illustrating the shifts was brought up to date by Greenwich (1955). WALDMEIER (1939) calculated a drift of 2° per year toward the equator. The cause of the displacement remains among the least understood phenomena. However GLAZER and the author in 1955 computed the annual sum of H for each degree of latitude for the years 1937–1953. The computations for 1937 suggested the hypothesis that several zonal drifting zones occur in each hemisphere. The latitude of maximum activity does not move but seems to jump. To illustrate this multizonal concept the author has drawn enclosing maxima which might reasonably be considered as springing from a single belt of activity—a second graph of local minima helped locate the boundaries of the caterpillar drawings. The structure of the sunspot zone is seen as a function of heliographic latitude. Several zones of activity develop in each solar hemisphere, the zones remain stationary in latitude, and are just sufficiently out of phase to simulate the latitude shift over the solar cycle. *Subject Heading:* **1. Sunspot structure.**—*E.Z.S.* Ⓢ

11L–242 523.746

Chistiakov, V. F., **K voprosu o tsirkuliatsionnoĭ prirode 11-letnikh tsiklov solnechnoĭ aktivnosti.** [Circulatory nature of the 11 year cycle of solar activity.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(3):425–435, May/June **1960.** 4 figs., 3 tables, 18 refs., 2 eqs. Russian and English summaries p. 425. Transl. into English in *Soviet Astronomy AJ*, New York, 4(3):405–414, Nov./Dec. **1960. DLC**—An attempt is made to explain several peculiarities in the development of the 11 year cycles on the basis of Spörer's law, which is interpreted as evidence of meridional circulation in the surface layer of the Sun. It is emphasized that although the cycles are of different intensity, they all have many common features connected with the latitude drift of the spot zone: a) the invariance of form of Spörer's curves $\bar{\varphi}(t)$, b) the possibility of matching the ends of the descending branches of the cyclic curves, c) a constant mean latitude of the zone at the end of the cycle, etc. The analysis of the cyclic migration of the N_φ curves of annual distribution of spot numbers in latitudes gives a possibility of determining the epoch of maximum of the cycle on the basis of Spörer's law. The established fact that the meridional circulation velocity decreases at the end of a cycle is used for explaining the different duration of the ascending and descending branches of the cyclic curve. All of the observational data are in satisfactory agreement with the circulatory scheme of cyclicity proposed by BJERKNES. The rise of the cyclic curve is explained by the approach of the active zone to the surface, the fall—by its descent. In this sense the epoch of maximum of the cycle is a boundary, dividing the ascent and descent of the active zone. *Subject Headings:* **1. Solar activity 2. Sunspot cycles.**—*Author's abstract.* Ⓢ

11L–243 523.746

Cragg, Thomas A. (*Mt. Wilson and Palomar Obs.*), **Solar activity in 1958.** *Astronomical Society of the Pacific, San Francisco, Publications*, 71(420):212–215, June **1959.** fig., 3 tables. **DLC**—A report of the observations of the sun made at Mt. Wilson during 1958. The observations were made on 339 days. On the remaining 26 days observations were impossible. This year the total number of sunspot group was 910, the largest number ever observed here in one year. Monthly means of the number of groups observed per day at Mt. Wilson for the last three years are tabulated. Also tabulated are the largest sunspot groups of 1958 and a list of great geomagnetic storms. *Subject Headings:* **1. Solar activity data 2. Sunspot data 3. Mt. Wilson, Calif.**—*I.S.* Ⓢ

11L–244 523.746

Gleissberg, W., **Zur Sonnentätigkeit vor 1750.** [Solar activity before 1750.] *Die Naturwissenschaften*, Berlin, 47(9):197, May, 1, **1960.** 2 figs., 5 refs. **DLC**—CHERNOSKY and HAGAN have made a reduction of the relative numbers of sunspots determined by WOLF for the period 1700–1748 with the purpose of making the numbers comparable to the values of the Wolf scale based on the series of mean monthly relative numbers of sunspots after 1749. The author gives 2 figs. permitting to con-

clude that in the tables of minima and maxima before 1750, the ordinates rm and RM show exactl the character of minima and maxima of solar activity before that period. *Subject Headings:* **1. Sola activity 2. Sunspot numbers 3. Sunspot cycles.**—*A.V.* Ⓢ

11L–245 523.746:551.510.535:621.396.812.4

Hitchcock, R. J.; Evans, G. O. and Naismith, R., **Sunspot-cycle variations in the discrepancie between predicted and observed frequencies for use in radiocommunication.** *Institution of Electrici Engineers, London, Proceedings, Pt. B,* 107(35):423–426, Sept. **1960.** 6 figs., foot-ref. **DLC** (TK1.I4 —A marked variation occurs over the sunspot cycle in the discrepancies between predicted F2-400 km m.u.f. and the observed times of fade-in and fade-out on an 18.4 Mc/s Bombay-London circui This is particularly marked in summer and is attributed to the influence of the sporadic E laye although there is no marked sunspot-cycle effect attributed to this layer. Any assessment of th accuracy of predictions analyzed on the assumption of F layer propagation must be considered i relation to the phase of the sunspot cycle to which it refers. *Subject Headings:* **1. Sunspot effects o ionosphere 2. Ionospheric radio wave propagation.**—*Authors' abstract.* Ⓢ

11L–246 523.74

Künzel, H. (*Potsdam*), **Statistische Untersuchungen uber Häufigkeit, Zonenwanderung un Lebensdauer von Sonnenflecken im 18. Aktivitätszyklus.** [Statistical studies of the frequencie zonal displacement and lifetime of sunspots during the 18th activity cycle.] *Astronomisch Nachrichten,* Berlin, 285(4):169–173, March **1960.** 2 figs., 4 tables, 14 refs. **DLC**—Between Feb 1944 and March 1954, 3670 sunspot groups were counted. The maximum frequency of all classe occurred in 1947. The following statistical data are given: The numerical distribution of each class– their location, the position of concentration of the frequency distribution of each class, the zonal di placement of each class and the average displacement distribution times and average error in day and the average life duration of each class. Waldmeier's classification of sunspot classes is use *Subject Heading:* **1. Sunspot data.**—*E.Z.S.* Ⓢ

11L–247 523.74

Kliakotko, M. A. (*P. K. Shternberg State Astron. Inst.*), **The significance of correlation coeff cients of the velocities of latitude displacement of nonrecurrent sunspots for several years.** *Sovi Astronomy AJ,* New York, 3(3):534–536, Dec. **1959.** table, 2 refs., 2 eqs. **DLC.** Transl. of veroiatnosti koeffitsientov korreliatsii poleĭ skorosteĭ dvizhenii nevozvrashchaiushchikhsia solne chnykh piaten po shirote razlichnykh godov, *Astronomicheskiĭ Zhurnal,* Moscow, 36(3):550–55 May/June **1959. DLC**—An estimate is made of the probability that the correlation coefficients c the velocities of latitude displacement of nonrecurrent sunspots for a number of years arise purely b chance. It is shown that this probability is small, i.e., the coefficients are not spurious quantities which confirms the presence of structure in the velocity field describing the motion of nonrecurren sunspots along the latitude. *Subject Headings:* **1. Sunspot correlation 2. Sunspot movements.**— *Author's abstract.* Ⓢ

11L–248 523.74

Kliakotko, M. A., **O prinadlezhnosti poleĭ skorosteĭ dvizhenii nevozvrashchaiushchikhsi solnechnykh piaten po shirote razlichnykh godov k odnoĭ sovokupnosti.** [Latitudinal motions c nonrecurrent sunspots in latitude for different years to a certain totality.] *Astronomicheskiĭ Zhurna* Moscow, 37(2):350–352, March/April **1960.** table, 3 refs., 3 eqs. Russian and English summarie p. 350. Transl. into English in *Soviet Astronomy AJ,* New York, 4(2):330–332, **1960. DLC**—It shown that the velocity fields describing the motions of nonrecurrent sunspots in latitude in differen years comprise a single aggregate; the significance of the differences between correlation coefficient is estimated for this purpose. *Subject Heading:* **1. Sunspot movements.**—*Author's abstract.* Ⓢ

11L–249 523.74

Koeckelenbergh, A., **Observations de l'activité solaire en 1958.** [Observations of the sola activity in 1958.] *Ciel et Terre,* Brussels, 75(11/12):361–364, Nov./Dec. **1959. DWB, DLC**— survey of the solar activity is given, month by month, for the year 1958. It is based on optica observations made at Uccle and radioelectric observations made at Humain. Wolf's monthl relative number at Uccle for the different months of the year 1958 are tabulated. *Subject Heading* **1. Solar activity data 2. Uccle, Belgium 3. Humain, Belgium.**—*A.V.* Ⓢ

11L–250 523.747:523.74

†Loughhead, R. E. and Bray, R. J. (*both, Univ. Grounds, Chippendale, N. S. W.*), **Observation of faculae bordering small sunspots near the limb.** *Australian Journal of Physics,* Melbourn 12(1):97–99, March **1959.** 2 plates, 7 refs. **DLC**—The report describes the location and appearanc of sunspots and associates these with the white light faculae which are always observed near the limb

Films of sunspots have been examined and the characteristics of each group are discussed. Several interpretations given to the observations include one in which the facular "clouds" over the small umbral areas of the spots have been identified as being similar. It is accepted that there is an existence of such clouds over the spots. *Subject Headings:* **1. Solar faculae 2. Sunspot data.**—*N.N.* Ⓢ

11L–251 523.746:778.34

Loughhead, R. E. and Bray, R. J. (*both, Div. of Physics, C. S. I. R. O., University Grounds, Chippendale, N. S. W.*), **The lifetime and cell size of the granulation in sunspot umbrae.** *Australian Journal of Physics*, Melbourne, 13(2):139–144, June **1960.** 2 figs., table, 2 plates, 12 refs. **DLC**—High quality photographs extending over a period of 2 hr 11 min have been obtained of the granulation in the umbra of a large sunspot. In agreement with earlier work, the mean cell size of the umbral granulation is found to be significantly less, and the lifetime considerably greater, than that of the photospheric granulation. Ten percent of the umbral granules last for over 2 hr. The majority of the umbral granules, like the photospheric granules, show no detectable change in brightness, size, or shape during the periods over which they are observed to persist as identifiable structures. Some information is obtained about the modes of formation and dissolution of individual granules. The similarity between the photospheric and umbral granulation is pointed out, and the possible role played by convective processes in sunspots is briefly discussed. *Subject Headings:* **1. Sunspot structure 2. Solar photography 3. Solar granulation.**—*Authors' abstract.* Ⓢ

11L–252 535.242:523.746

Makita, Mitsugu and Morimoto, Masaki (*both, Tokyo Astron. Obs.*), **Photoelectric study of sunspots.** *Astronomical Society of Japan, Tokyo, Publications*, 12(1):63–76, **1960.** 7 figs., 2 tables, 17 refs., 7 eqs. **DLC**—The continuum of sunspot spectra was observed simultaneously at three wave lengths with the tower telescope of the Tokyo Astronomical Observatory, using a photoelectric device and a rotating prism which reduced the effect of scintillation appreciably. The intensity ratio to area relation and the limb effect of sunspots are obtained and from the latter the temperature distribution is derived for the penumbra and the umbra (5500°K and 4100°K at $\tau \sim 0.5$ respectively). The obtained temperature distribution of the umbra with an area $=70.10^{-6}$ of solar hemisphere is on the average 500°K lower than MICHARD'S. *Subject Headings:* **1. Sunspot observation techniques 2. Photoelectric observation techniques.**—*Authors' abstract.* Ⓢ

11L–253 523.746:621.396.1

Minnis, C. M. (*Radio Res. Station, Slough, Bucks*), **An estimate of the peak sunspot number in 1968.** *Nature*, London, 186(4723):462, May 7, **1960.** 4 refs. **DWB**—The operating conditions of high frequency radio communication links are profoundly modified by changes in solar activity. It is of importance, therefore, to estimate the probable limits within which the forthcoming peak sunspot number will lie. From the study of the length of sequences of uninterrupted increases and decreases it is possible to estimate the probability of occurrences. The probability of a fourth increase higher in 1968 than in 1958 is approximately 0.3. The range of values can be estimated from the frequency distribution of the observed peaks as from the differences between successive peaks. It was found that the 1968 peak will be in the range 110–160. *Subject Headings:* **1. Sunspot maximum forecasts 2. Solar-radio communication relationships.**—*E.K.* Ⓢ

11L–254 523.746

Ol', A. I., **O vozmozhnoĭ periodichnosti solnechnoĭ deiatel'nosti.** [On the possible periodicity of solar activity.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(2):222–226, March/April **1960.** 4 tables, ref. Russian and English summaries, p. 222. **DLC.** Transl. into English in *Soviet Astronomy AJ*, New York, 4(2):212–216, **1960. DLC**—NEWCOMB'S hypothesis that there is a strict periodicity with a period of **11.13** years at the base of transient development of solar activity was verified using more complete and recent data. The investigation showed the correctness of this hypothesis; the deviations of the observed epochs of the extremes of Wolf numbers from those computed on the basis of this hypothesis are not accidental but depend on the general level of solar activity. Some of the derived correlations have been used for the prediction of the epochs of minimum and maximum of the following 11 year cycle of solar activity. *Subject Headings:* **1. Solar activity 2. Sunspot cycles.**—*Author's abstract.* Ⓢ

11L–255 523.746

Romanchuk, P. R. and Kudinova, T. P. (*both, Kiev State Univ.*), **On the east-west asymmetry of spot formation activity of the sun.** *Soviet Astronomy AJ*, New York, 3(4):721–723, Jan./Feb. **1960.** fig., table, 6 refs. **DLC.** Transl. of **K voprosu o vostochno-zapadnoĭ asimmetrii piatnoobrazovatel'noĭ deiatel'nosti Solntsa,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(4):743–745, July/Aug. **1959. DLC**—The weak points in the results obtained by GLEISSBERG and WALDMEIER, concerning the explanation of the east-west asymmetry in the appearance of spot groups are pointed out. In order to elucidate the nature of the east-west asymmetry, an attempt was made to study the character of

the spot-group distribution over the solar disc, taking into account the peculiarities of development of each group. Greenwich data for 1935, 1937 and 1939–1946 were used. In the study of the spot-group development it was assumed that the development of the areas during the first days of the existence of spots was linear. The existence of an east-west asymmetry in the appearance of groups during 1935, 1937 and 1939–1946 was confirmed, showing that the asymmetry is not due to the effects of rotation, projection, or the development of spots, but appears as a result of the distribution of centers of spot formation, the nature of which should depend on physical conditions. *Subject Headings:* **1. East-west asymmetry of sunspot activity 2. Sunspot activity.**—*Authors' abstract.* Ⓢ

11L–256 550.385.4:523.746

Summary of Mount Wilson magnetic observations of sunspots for September and October, 1958. *Astronomical Society of the Pacific, San Francisco, Publications,* 71(418):58–63, Feb. **1959.** table. **DLC**—Data of magnetic observations of sunspots for Sept. and Oct. 1958 are presented in tabular form. The tables show the geomagnetic storm occurrences, the number of sunspots observed daily and magnetic classifications of sunspots. The accompanying text explains the tables. Solar activity during Sept. and Oct. 1958 is reported as very high. *Subject Headings:* **1. Sunspots and magnetic storms 2. Magnetic observations.**—*I.S.* Ⓢ

11L–257 523.746:523.755

†Tamburini, T. and Thiessen, G., **Center-limb variation of the slowly variable earth magnetic effective solar x-ray radiation and remarks on the structure of coronal condensations.** *Milan. Osservatorio Astronomico di Milano-Merate (Brera), Contributi,* Nuova Ser., No. 148, **1959.** 23 p. 6 figs., 3 tables, 20 refs., eqs. **DWB**—The authors indicate that in order to investigate correlations of daily values of certain phenomena with sunspot numbers, it is necessary to account for possible differences between center-limb variations of the Wolf number of a single spot group and of additional radiation originating in the surroundings of the same group. A maximum correlation coefficient results if the sunspot number for the whole disk is calculated with the same center-limb-variation as is valid for the additional radiation. It is suggested that the coronal condensations probably are regions with higher densities but lower temperatures as compared to the neighboring general corona. *Subject Headings:* **1. Coronal condensations 2. Sunspot group correlations 3. Solar X-radiation.**—*E.Z.S.*

11L–258 523.746:551.521.6/9

Vegard, L., **Report on spectrographic work at Tromsö and Oslo.** *Journal of Atmospheric and Terrestrial Physics,* London, 15(1/2):175, Sept. **1959. DLC**—The results of a study of properties of the solar bundles, formed by photoelectrons from sunspot regions and neutralized by protons, are presented. *Subject Headings:* **1. Solar spectroscopy 2. Norway.**—*O.T.* Ⓢ

FLARES

See also: **Association of solar radio bursts with flares** (Swarup et al.), 11L–94; **Decrease of solar radio emission during flare** (Kakinuma, Hiei), 11L–95; **Radio noise storms and flares** (Malinge), 11L–99; **Type III bursts and flares** (Rabben), 11L–100; **Flare surges and type III bursts** (Giovanelli), 11L–101; **Solar flare radiation and modulation effects** (Ehmert et al.), 11L–228; **Sunspot and flare statistics** (Bell), 11L–240.

11L–259 523.75:551.521.64

Chubb, T. A.; Friedman, H. and Kreplin, R. W. (*all, U. S. Naval Res. Lab., Wash., D. C.*), **Measurements made of high-energy X-rays accompanying three class 2^+ solar flares.** *Journal of Geophysical Research,* Wash., D. C., 65(6):1831, June **1960.** fig., table, ref. **DLC**—Peterson-Winkler (1959) X-ray flash is a different phenomenon from the X-ray tail observed by the authors. The energy distribution suggests a somewhat different emission character than that postulated by Peterson-Winkler, such as bremstrahlung from thermalized electrons, possibly an extension of the normal coronal emission. *Subject Headings:* **1. Solar flares 2. Solar X-radiation.**—*E.Z.S.* Ⓢ

11L–260 523.75:778.3

Cragg, Thomas A. (*Mt. Wilson and Palomar Obs.*), **Photograph of a "white light" flare.** *Astronomical Society of the Pacific, San Francisco, Publications* 71(418):56–57, Feb. **1959.** plate, 2 refs. **DLC**—A description of a flare estimated as of importance 1, photographed with the 13-foot spectroheliograph on Mt. Wilson during the regular morning observations on June 19, 1958. Photographs showing simultaneous spectroheliograms of the western half of the sun on June 19 in K_2 and at λ3832 are presented. Two enlargements of these photographs are also given. *Subject Headings:* **1. Solar flares 2. Solar photography.**—*I.S.* Ⓢ

11L–261 551.501.83:551.508.86:523.75

Del Vecchio, Philip J., **Indirect detection of solar flares.** *Sky and Telescope*, N. Y., 18(10): 546–548, Aug. **1959.** figs. (incl. photos) **DWB, DLC**—A sudden enhancement of atmospherics is an important indirect indicator of solar flares. This paper describes the equipment used for recording atmospherics and its modest cost. The atmospherics receiver, antenna, characteristics, auxiliary equipment and the technique of recordings are discussed. Diagram and photographs of SEA detector and graphical representations of atmospherics recordings nicely illustrate the discussion. *Subject Heading:* **1. Sudden enhancements of atmospherics 2. Solar flare effects on atmospherics.** —*I.S.* Ⓢ

11L–262 523.75

Ellison, M. A.; McKenna, M. P. and Reid, J. H. (*all, Dunsink Obs.*), **The solar flare of 1960 April 1.** *Observatory*, London, 80(917):149–152, Aug. **1960.** 2 figs., plate, 4 refs. **DWB, DLC** (Q1.P5)—A series of flares occurred in the period March 28 -April 6. The peculiar and temporary change in the striation pattern which occurred during the flare of April 1 is described and discussed. *Subject Headings:* **1. Solar flares.**—*R.B.* Ⓢ

11L–263 523.75

Ellison, M. A.; McKenna, Susan M. P. and Reid, J. H. (*all, Dublin Inst. for Advanced Studies, School of Cosmic Physics, Dunsink Obs.*), **The solar flare of June 1, 1960.** *Nature*, London, 187(4741): 926, Sept. 10, **1960.** photo. **DWB**—An analysis has been made of film in Hα light taken with the Lyot heliograph at the Royal Observatory, Cape of Good Hope, of a solar flare in the 3^+ category of importance which occurred on June 1. The flare was one of the largest observed in recent years comparable in area with that of July 25, 1946. The flare was of the complex E-type containing 24 spots. A severe sudden ionospheric disturbance was reported at the same time by the Tatsfield Receiving Station of the BBC. *Subject Heading:* **1. Solar flare, June 1, 1960.**—*R.B.* Ⓢ

11L–264 550.385.4:523.75

International Geophysical Year, 1957/1958, **Solar flares, geomagnetic disturbances, and WWA decisions, third quarter 1959.** *American Geophysical Union, Transactions*, 41(1):87–88, March **1960. DWB, DLC.** "See *IGY Bulletin* No. 28 and the indexes to *IGY Bulletins*, No. 1–24, pub. in No. 12 and 24 for earlier reports in this series." "One of a series of reports issued periodically through IGY and International Cooperation, 1959."—During July 1–Sept. 30, 1959, a general increase in geomagnetic activity was observed, as shown by the greater frequency, severity, and duration of disturbances. On July 15 the most severe geomagnetic storm was recorded. The storm was associated with a great flare observed in an extremely active region in the vicinity of the sun's central meridian. Other geomagnetic disturbances during the third quarter of 1959 are noted. A list of major solar flares, geomagnetic disturbances, world-wide geophysical alerts, and SWI for the third quarter of 1959 is given. *Subject Headings:* **1. Geomagnetic disturbances 2. Solar flares 3. IGY World Warning Agency.**—*I.S.* Ⓢ

11L–265 551.594.6:523.75

*Kamada, Tetsuo, **Statistical properties of the sudden enhancement of atmospherics in V.L.F. range.** *Nagoya Univ. Research Institute of Atmospherics, Proceedings*, 7:28–39, Jan. **1960.** 12 figs., 11 tables, 3 refs. **DWB** (M(05)N152p)—Describes the statistical results obtained in five years (1955 to 1959) with regard to sudden enhancement of atmospherics (SEA) caused by solar flare disturbances. First, some statistical results concerning the general properties of SEA are presented, and then the correlation of simultaneous occurrence among solar flare, solar radio outburst, and SEA is considered. It is concluded that the basic modes and types of SEA are determined from among the abnormal increase of the intensity of atmospherics. The observation of three frequency components about 10, 20 and 30 kc/s simultaneously is necessary to determine the abnormal increase of the intensity of atmospherics as SEA. The paper is extensively illustrated by tables and graphic presentations. *Subject Headings:* **1. Sudden enhancements of atmospherics 2. Solar flare effects on atmospherics.**—*I.S.* Ⓢ

11L–266 551.594.6:523.75

Kleczek, J. and Křivský, L. (*both, Astronomical Inst., Ondřejov, Czechoslovakia*), **Solar limb surges accompanied by X-ray emission.** *Nature*, London, 186(4730):1035–1036, June 25, **1960.** table, 6 refs. **DWB**—Sudden enhancements of atmospherics during solar flares as observed at the Astronomical Institute, Ondřejov, Czechoslovakia, were investigated, selecting only those limb surges whose disturbed chromospheric region was behind the limb on the back side of the sun, and excluding those coinciding in time with other Hα events on the sun other than surge appearances. The list of the remaining limb surges combined with data of sudden enhancements of atmospherics are shown in a table. These simultaneous phenomena are interpreted as X-ray radiation emitted by the

adjacent region of the solar corona. *Subject Headings:* **1. Sudden enhancements of atmospherics 2. Solar flare effects on atmospherics 3. Solar X-radiation.**—*O.T.* Ⓢ

11L–267 523.75:535.33.018

Michard, R.; Servajean, R. and Laborde, J. (*Paris-Meudon Observatory*), **Spectroscopie des éruptions solaires dans le programme français de l'A.G.I. I. Instruments et observations.** [Spectroscopy of 1# solar eruptions in the French program of the I.G.Y. Instruments and observations.] *Annales d'Astrophysique*, Paris, 22(6):877–886, **1959.** fig., 2 plates, 3 refs. French, English and Russian summaries p. 877. **DWB, DLC**—For the IGY a laboratory devoted to the spectroscopic study of flares and associated phenomena has been installed at the Pic du Midi Observatory. The main instrument is a spectrograph that can photograph in a single exposure the whole solar spectrum from λ3550 to about 9000 Å, with a mean dispersion of 1# 2 Å/mm. A Lyot-type H_α filter is used to detect flares and bring them on the slit. Auxiliary arrangements include H_α photography of the flare under study, and possibility of fast cinematography of the H spectra of an extended solar region. *Subject Headings:* **1. Solar eruptions 2. Solar spectroscopy 3. French participation in IGY 4. Pic du Midi, France.**—*Authors' abstract.* Ⓢ

11L–268 523.75:535.33

Severnyĭ, A. B.; Steshenko, N. P. and Khokhlova, V. L., **Spectroscopy of solar flares with echelette gratings.** *Soviet Astronomy AJ*, New York, 4(1):19–30 July/Aug. **1960.** 5 figs., table, 4 refs., eqs. **DLC.** Transl. of **Spektroskopiia solnechnykh vspyshek s eshele,** *Astronomicheskiĭ Zhurnal*, Moscow, 37(1):23 31 Jan./Feb. **1960. DLC**—An attempt to apply an echelette grating for the spectroscopy of solar flares and other nonstationary processes on the sun with the aid of the Solar Tower telescope is described. The optical scheme of the spectrograph is illustrated. The echelette was made by F. M. Gerasimov and allows the solar spectrum in the range λ3700–6600 A to be obtained in the form of adjacent strips covering a 13 cm × 18 cm plate. The dispersion is ≃1 A/mm, the resolving power ≃0.04 A, and the exposure of 0^{m}5. Examples of the spectra of the sun and solar flares are given. With the echelette it is possible to detect a large number of emission lines in flare spectra. The hydrogen lines in individual cases can be seen as far as H_{22}, about 12 lines of He (including λ4686 HeII) can be detected, and more than 450 metallic and other lines can be identified in flare spectra. A catalog is given of emission lines in the spectrum of the flare of Aug. 17, 1959, obtained with the echelette grating. *Subject Headings:* **1. Solar flare emission 2. Solar spectroscopy.**—*Authors' abstract.* Ⓢ

11L–269 523.75

Slonim, Iu. M., **Moshchnye khromosfernye vspyshki 10 i 14 iiulia 1959 g.,** [Intense chromospheric flares of July 10 and 14, 1959.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(2):347–349, March/April **1960.** 2 figs., table, ref. Russian and English summaries p. 347–348. Transl. into English in *Soviet Astronomy AJ*, New York, 4(2):327–330, **1960. DLC**—Results are given of observations of two intense chromospheric flares, which appeared on July 10 and 14 above a large, irregular sunspot. A similarity in the structure of the flares is noted. Their development is evidence of eddy, or pseudoeddy, motions and of a systematic movement of the principal emission node in a western direction. The ionospheric effects due to these flares are described. *Subject Headings:* **1. Chromospheric flares 2. Solar flare effects on ionosphere.**—*Author's abstract.* Ⓢ

11L–270 523.75

Solar flare of May 10, 1959. *Sky and Telescope*, N. Y., 18(10):544–545, Aug. **1959.** photos. **DWB, DLC**—An illustrated discussion of the solar flare of importance 3+ which occurred on May 10, 1959. This flare ranks as one of the largest and brightest yet observed. It occurred in the vicinity of a spot group on the northeast quadrant on the sun, fairly near the limb. Simultaneously with the appearance of the flare, there also began a sudden enhancement of atmospherics. Two photographs, one photographed in red light of hydrogen and the other a monochromatic picture illustrate the description. The record of radio bursts obtained on May 10th at the Harvard Radio Astronomy Station in Texas is also photographically shown. Other phenomena probably induced by this gigantic flare are described. *Subject Headings:* **1. Solar flare, May 10, 1959 2. Solar flare effects on atmospherics.**—*I.S.* Ⓢ

11L–271 523.75:535.33:546.11

Suemoto, Zenzaburo and Hiei, Eijiro (*both*, Tokyo Astron. Obs.), **Balmer series lines of the flare and its structure.** *Astronomical Society of Japan, Tokyo, Publications*, 11(4):185–194, **1959.** 2 figs., 10 refs., several eqs. **DLC**—The line widths of Balmer series lines from H_α to H_{14} were measured on a number of spectrograms of flares of medium importance taken by a wide range spectrograph with the dispersion of 3 A/mm. The width is very wide for the earlier members and decreases to a minimum somewhere around H_9 and then increases slowly to higher members. By

assigning the Stark broadening to higher members and the self absorption to lower members the authors derived the values of the electron density and total number of hydrogen atoms in the second quantum state. On the basis of uniform model of the flare these two values can only be made compatible when the very small geometrical thickness of the order of 10 km is attributed to the whole extension of the flare. It is suggested therefore, that the flare is composed of unresolvably fine, presumably thread-like, condensations distributed over the whole extension. *Subject Headings:* **1. Balmer series 2. Solar flares.**—*Authors' abstract.* Ⓢ

CHROMOSPHERE, PROMINENCES, FILAMENTS

See also: **Association of solar radio bursts with prominences** (Swarup et al.), 11L–94.

11L–272 523.752

de Jager, C. (*Sterrewacht Sonnenborgh, Utrecht*), **Dynamical features of the chromosphere.** *Nuovo Cimento*, Bologna, Supplement No. 1 to Ser. 10, Vol. 13, **1959.** p. 291–298. 2 figs., 3 tables. **DLC**—The chromosphere is treated mainly descriptively. Some theories on its dynamics are surveyed, including a discussion of the energy balance of the chromosphere. The chromosphere and its thermal and mechanical properties are briefly characterized, then each of them is surveyed separately in more detail The structure of the chromosphere and its temperature distribution are illustrated. The chromospheric energy balance and the heating of the corona are analyzed showing in a table the layers in relation to photospheric radiation flux, mechanical flux, emission of its radiation and heat conduction. The transition layer between chromosphere and corona is determined by radio-observations of the quiet sun indicating different relations for the polar and equatorial parts of the corona. The conductive energy flux and its density are examined. *Subject Heading:* **1. Chromosphere.**—*O.T.* Ⓢ

11L–273 523.752:523.036.33

Kawaguchi, Ichiro (*Kyoto Univ.*), **On the emission curves of growth of Fe I and Ti II in the lower chromosphere.** *Astronomical Society of Japan, Tokyo, Publications*, 11(3):138–150, **1959.** 9 figs., 4 tables, 27 refs., numerous eqs. **DLC**—Under the assumption of pure absorption mechanism, the density and temperature distributions in the lower chromosphere are derived by the method of emission curves of growth, taking the turbulent velocity distribution observed by REDMAN and SUEMOTO into consideration. The density distribution thus obtained seems reasonable judging from the observed behavior of SrII resonance lines λλ4077 and 4215. It seems improbable that the flash lines are formed by pure absorption mechanism, for the following reasons: (1) the radiation temperature 5200°, deduced from the emission curves of growth, is considerably different from the excitation temperature 4150°, derived empirically. (2) On the basis of density distribution derived here, the center of some strong Fraunhofer lines of Ti II will be formed in the lower chromosphere. The radiation temperature 5200° is much higher than that derived from the residual intensities of these lines under the assumption of pure absorption. *Subject Heading:* **1. Chromospheric structure.**—*Author's abstract.* Ⓢ

11L–274 535.243:523.752/3

Khokhlova, V. L. (*Acad. Sci., U.S.S.R.*), **A spectrophotometric investigation of the H and K Ca^+ lines in the chromosphere and solar faculae.** *Soviet Astronomy AJ*, New York, 3(1):59–68, Jan./Feb., **1959.** 6 figs., 3 tables, 26 refs. **DLC.** Transl. of **Spektrofotometricheskoe issledovanie linii H i K Ca^+ v khromosfere i solnechnykh fakelakh,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(1): 54–64, Jan./Feb. **1959. DLC**—The study of the H and K lines of ionized calcium at various distances from their centers allows the conditions at different depths of the solar atmosphere to be investigated. The form of the profiles of the H_2, K_2 H_3 and K_3 lines shows that incoherent scattering does not play an essential role in the formation of these lines. The upper limit to the value of the turbulent velocity has been derived from the H_3 and K_3 profiles and found to be 8 km/sec. The height of formation of these lines has been calculated and equals 5000 km. The analysis of the published determinations of turbulent velocity from the half-widths of the lines shows that all metallic lines, as well as hydrogen, give a turbulent velocity in the chromosphere not exceeding 8 km/sec. The high values of v_t, derived by UNSOLD and DE JAGER, were due to the use of helium lines, which are broadened because of a high kinetic temperature. The investigation of the profiles of the H_1 and K_1 lines in continuous emission granules in facula regions shows that the hypothesis that these grains are optically thin formations agrees with observational data. The optical depth τ_0 (in the frequencies of the continuous spectrum) of formation of these grains has been determined from the weakening of the continuous emission strip towards the center of the H and K lines. For 7 grains, it varies from $\tau_0 = 0$ to $\tau_0 \approx 1$. *Subject Headings:* **1. Spectrophotometric observations 2. Chromosphere 3. Solar faculae.**—*Author's abstract.* Ⓢ

11L–275 523.752:546.291

Namba, Osamu (*Osaka Univ. of Kyoto*), **Note on the excitation of the ionized helium in the solar chromosphere.** *Astronomical Society of Japan, Tokyo, Publications*, 11(1):50–53, **1959.** 10 refs. **DLC**—The α-particles carried from the corona by some hypothetical "hot streams" may be a source of the high excitation of the He II spectrum in the low-temperature chromosphere. Significance of the far ultraviolet radiation, also carried by the hot streams, is suggested. *Subject Headings:* **1. Chromosphere 2. Helium in chromosphere.**—*Author's abstract.* Ⓢ

11L–276 523.752:551.521.17:535.34:546.211

Nikol'skiĭ, G. M., **Ul'trafioletovoe izluchenie i vozbuzhdenie kislorodnykh liniĭ v khromosfere.** [The ultraviolet radiation and excitation of oxygen lines in the chromosphere.] *Akdamiia Nauk SSSR, Doklady*, 130(1):51–52, **1960.** fig., 6 refs., 3 eqs. **DWB, DLC**—The multiplets OI of the system of quintets λλ7771.95, 7774.18, 7775.89 and the system of triplets λλ8446.35, 8446.73 and 8447.66 are characterized by a rather high (~10 ev) potential of disturbance of the upper layers. The lower level of the multiplets combined with the adjacent principal layer gave lines of λλ1302.2, 1304.8, 1310 (triplet) and λλ1355.6, 1358.5—forbidden along the back of the line. The source of disturbance of the central levels for λλ8446 and 7774 ($^3P_{2,1,0}$; $^5P_{1,2,3}$) is regarded as an electron bombardment. But in the case of triplets the initial level $^3P_{0,1,2}$ for the emission λ8446 may be a cascade transition with the upper lying level $^5D_{3,2,1}$ excited by radiation of the chromosphere in the line L_β1025.73 Å. The action of the mechanism under solar atmospheric conditions is examined by solving systems of equations of the microstationary state separately for triplets and quintets of OI and thereby finding the populousness of initial levels for λλ8446 and 7774; taking into consideration the action of L_β-radiation. It is shown that, in the chromosphere, with increased density of L_β radiation the emission lines of λ8446 are substantially intensified. The ratio of the intensities of the chromospheric lines I_{8446} I_{7774} the possibility of measuring L_β intensity on different chromosphere regions, etc. are discussed. *Subject Headings:* **1. Chromosphere 2. Oxygen lines 3. Ultraviolet radiation.**—*I.L.D.* Ⓢ

11L–277 523.752

Cragg, Thomas (*Mt. Wilson and Palomar Obs.*), **The eruptive prominence of June 15, 1958.** *Astronomical Society of the Pacific, San Francisco, Publications*, 71(421):307–309, Aug. **1959.** fig., table, plate. **DLC**—A descriptive account of a large, moderately bright prominence, observed at the southwest limb of the sun from June 12 to 15, 1958 with the 60-foot tower telescope on Mt. Wilson. A series of photographs were made of the eruptive stages during this time. Five of these photographs are presented in this paper. In tabular form the position for several days of the probable termini and the three most likely positions on the 15th are given. A height diagram for the eruptive prominence is also shown. *Subject Heading:* **1. Solar prominences.**–*I.S.* Ⓢ

11L–278 523.762:539.12

†Ivanov-Kholodnyĭ, G. S., **The electron density in solar prominences.** *Soviet Astronomy AJ*, New York, 3(4):578–587, Jan./Feb. **1960.** fig., 2 tables, 49 refs., 5 eqs. **DLC.** Transl. of **Elektronnaia plotnost' v solnechnykh protuberantsakh,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(4):589–600, July/Aug. **1959. DLC**—Experimental determinations of the physical parameters of prominences are discussed. The kinetic temperature calculated from the half-widths of lines broadened by the Doppler effect is $T_{kin}=6000$–$9000°$. The electron density found from the Stark effect, which affects the half-widths and the far winds of hydrogen line profiles and also the number of lines in the series, is $n_e=10^{12}$ cm^{-3}. The analysis of the spectrum of metals leads to similar values. From the data obtained by REDMAN it follows that n_e increases with height in the chromosphere. For prominences $\int_0^\infty n_e dH=10^{19}$ and $\int_0^\infty n_e^2 dH=10^{39}$, which on account of the nonhomogeneity of the prominences also give $n_e\sim10^{12}$ cm^{-3}. The hydrogen concentration in prominences is $n(H)\sim2\cdot10^{12}$ cm^{-3}. The ionization of hydrogen is considerable but far from complete. The effective thickness of the radiating layer of a prominence is $H=10^7$ cm. The size of the individual elements of the prominence is $D\sim2\cdot10^7$ cm, the weight, $4\cdot10^{16}$ g. *Subject Heading:* **1. Electron density in solar prominences.**—*Author's abstract.* Ⓢ

11L–279 523.752

Reid, John H. (*Dunsink Obs.*), **Distribution of sightline velocities in solar disk and limb phenomena.** *British Astronomical Association, Journal*, 70(3):123–129, March **1960.** 6 figs., 4 refs. **DWB, DLC**—During the International Geophysical Year, active observations of behavior of active prominences was carried on. Due to high velocities these phenomena cannot be followed with a spectroheliograph. In a paper by DODSON and DONSELMAN a comparison is made between spectra and spectroheliograms. An active dark filament was observed on 6 Feb. 1953 and is explained. A flare singe was observed on 2 April 1958 at N32°, E21°. Similarly an active prominence was ob-

served on 14 Aug. 1958. These three examples show that a large amount of information can be gained about active phenomena with large sight line velocities. A specially designed camera will make the work much easier. *Subject Heading:* **1. Solar prominences.**—*A.H.K.* Ⓢ

11L–280 523.77:523.752

Zirin, Harold and Tandberg-Hanssen, Einar, **Physical conditions in limb flares and active prominences, Pt. 4, Comparison of active and quiescent prominences.** *Astrophysical Journal*, Chicago, 131(3):717–724, May **1960.** 2 figs., 4 tables, 16 refs. **DWB, DLC**—Spectra of active and quiescent prominences appearing simultaneously at the limb of the sun are analyzed and discussed. The quiescent prominence shows a spectrum identical with that of the chromosphere at 1500 km, with strong lines of H, He I, and ionized metals and weak He II. The active prominence shows strong He II and very weak ionized metal lines. The lines in the active prominence are very much broader. The width of lines in either prominence is shown to depend on their excitation potential. It is proposed, as a result of many observations, that, except for strong lines such as those of hydrogen and Ca II, the spectra of prominences fall into two sharply defined classes, depending on whether they are "hot" or "cool." *Subject Headings:* **1. Solar prominences 2. Solar flares.**—*Authors' abstract.* Ⓢ

11L–281 550.385.4:523.753

Bednářová-Nováková, B. (*Czechosl. Acad. of Science*), **Recurrent geomagnetic storms and solar prominences.** *Journal of Geophysical Research*, Wash., D. C., 65(1):367, Jan. **1960.** 8 refs. **DWB, DLC**—A brief article about the hypothesis of the connection between filament-prominences and geomagnetic storms. The author refers to R. T. HANSEN, who cited one of her earlier papers and finds it necessary to give an explanation of the terminology and why her results are in contradiction to those of HANSEN. *Subject Headings:* **1. Geomagnetic storms 2. Solar filaments 3. Solar prominences.**—*E.K.* Ⓢ

11L–282 523.753:550.385.4

Dizer, Muammer (*Obs. de Kandilli, Istanbul*), **Sur la relation entre les disparitions brusques de filaments et les orages magnétiques.** [Relation between the sudden disappearance of filaments and magnetic storms.] *Annales de Géophysique*, Paris, 13(4):325, Oct./Dec. **1957.** 9 refs. **DLC**—The nature of the relationship between solar activity and perturbations of the earth's magnetic field is briefly discussed. Views of several investigators are cited. In the vicinity of the central meridian 22% of the sudden disappearances of filaments correspond with magnetic storms. The sudden disappearance of filaments in the vicinity of the central meridian is in part directly related to perturbations in the magnetic field. *Subject Headings:* **1. Solar filaments 2. Magnetic storms 3. Solar-geomagnetic relationships.**—*E.Z.S.* Ⓢ

11L–283 523.753 551.590.21:551.510.535:621.396.1

Koeckelenbergh, A., **Evolution d'un filament sombre lors de l'éruption solaire du 16 juillet 1959 (16h08m TU).** [Evolution of a dark surge at the time of the solar eruption on July 16, 1959 (16h08m UT).] *Ciel et Terre*, Brussels, 76(7/8):216–220, July/Aug. **1960.** fig., 3 plates, 8 refs. **DWB, DLC**—Description of the eruption of July 16, 1959 which occurred in a zone of heliographic coordinates 14 N 22 W. At the same time an important dark surge developed which showed a considerable asymmetry of the H_α-line profile. There is reason to believe that it was an arch-shaped prominence. The author gives a summary of the phenomena associated with this eruption. The conditions of ionospheric propagation were highly disturbed from July 15, and a magnetic disturbance was observed on July 17 at the geomagnetic station of Manhay (Belgium). Again a marked agreement was observed between the sudden enhancement of sferics and the optical eruptions. *Subject Headings:* **1. Solar eruptions 2. Solar filaments 3. Solar-ionospheric relationships 4. Sudden enhancements of atmospherics.**—*A.V.* Ⓢ

CORONA

See also: **Radio emissions scattered by coronal irregularities** (Pisareva), 11L–88; **Structure of coronal condensations** (Tamburini, Thiessen), 11L–257; **Eclipse photographs from South Pacific** (Sky & Telescope), 11L–310.

11L–284 535.33:523.755

Baturova, G. S.; Pominov, I. S.; Stolov, A. L. et al. (*all, V. I. Ulyanov-Lenin Kazan State Univ.*), **Spectroscopic observations of the solar corona during the total solar eclipse of June 30, 1954.** *Soviet Astronomy AJ*, New York, 3(2):247–253, March/April **1959.** 5 figs., 5 tables, 16 refs., 5 eqs. **DLC.** Transl. of **Spektroskopicheskie nabliudeniia solnechnoĭ korony vo vremia polnogo solnechnogo**

zatmeniia 30 iiunia 1954 g, *Astronomicheskiĭ Zhurnal,* Moscow, 36(2):247–253, March/April **1959. DLC**—Two spectrograms of the solar corona in the visual spectral region taken during the total solar eclipse of June 30, 1954 were analyzed. Five coronal lines were obtained in the coronal spectrum. The electron concentration in the corona for p from 1.05 to 2 was derived from the coronal component of the continuous spectrum. The results are in good agreement with published data. However, in our case that decrease of electron concentration with increasing p is somewhat slower than that found by other authors. *Subject Headings:* **1. Solar spectroscopy 2. Coronal emission lines 3. Eclipse observations of corona. I. Smirnova, N. N.**—*Authors' abstract.* Ⓢ

11L–285 523.755

Borisoglebskiĭ, L. A., **On the identification of Ca XV coronal lines.** *Soviet Astronomy AJ,* New York, 3(5):879–880, March/April **1960.** 13 refs. Transl. of **Ob otozhestvenii koronal'nykh liniĭ CA XV,** *Astronomicheskiĭ Zhurnal,* Moscow, 36(5):905–907, Sept./Oct. **1959. DLC**—The identification of Ca XV coronal lines is discussed. Results are reported of a recalculation of the ratio of intensities of the Ca XV lines λ5694.4 and λ5446.5 using recent theoretical data on transition probabilities. *Subject Heading:* **1. Coronal emission lines.**—*Author's abstract.* Ⓢ

11L–286 523.755:523.746

Bretz, Marianne C. and Billings, Donald E. (*both, High Altitude Obs., Colorado Univ.*), **Analysis of emission corona 1942–1955 from Climax spectrograms.** *Astrophysical Journal,* Chicago, 129(1): 134–145, Jan. **1959.** 8 figs., 18 refs. **DWB, DLC**—Climax measurements of coronal emission-line (λ5303 and λ6374) intensities for the years 1942–1955 were converted to an absolute scale averaged over each solar rotation at each 5° position angle, then summed over the active zone on the limb. Curves showing the variation of the emission with time are presented. The total emission in both coronal lines follows the sunspot cycle closely. For λ6374, however, the maximum at sunspot maximum is highly irregular and much less pronounced than for λ5303. We do not confirm the strong peak in the λ6374 emission during 1943 that was reported by Arosa. A study of the distribution of emission with latitude, at different parts of the sunspot cycle is also presented. We conclude that, although both electron density and electron temperature appear to be higher at sunspot maximum than at sunspot minimum, the intensity of emission in both λ5303 and λ6374 is determined primarily by electron density. We conclude also that for several months after the beginning of a new sunspot cycle an aggregate of cooler coronal gas from the preceding cycle remains near the solar equator. *Subject Headings:* **1. Coronal emission lines 2. Climax, Colo.**—*Authors' abstract.* Ⓢ

11L–287 523.755

Bronshten, V. A. (*Moscow Planetarium*), **The structure of the far outer corona of June 19, 1936.** *Soviet Astronomy AJ,* New York, 3(5):821–826, March/April **1960.** fig., table, 15 refs. Transl. of **Struktura dalekoĭ vneshneĭ korony 19 iiunia 1936 g,** *Astronomicheskiĭ Zhurnal,* Moscow, 36(5):845–850, Sept./Oct. **1959. DLC**—The structure of the far outer corona (at a distance of more than one solar diameter from the Moon's limb) was studied using photographs obtained during the solar eclipse of June 19, 1936 by the expeditions of the Moscow Branch of the Astronomical-Geodetical Society and the Kiev University Observatory. The plates were taken with an Astropetzval camera (f=96 cm) and a Cook astrograph (f=175 cm), using long exposures and light filters, to attenuate the light scattered by the sky. The coronal rays on the photographs extend to 5–8 R⊙. A description of the coronal rays and their crests is given and their relation to photospheric and chromospheric formation is considered. An attempt was made to elucidate the arrangement of the rays in space, Lyot's noneclipse observations being also used for this purpose. Prominences and dark filaments are situated at the base of all the long straight rays. Usually the rays issue exactly from the prominences and are inclined always from the radial direction toward the solar equator. If in the vicinity there are intense flocculi surrounding sunspots, the bases of the rays are displaced toward the flocculi but the rays themselves are inclined toward the pole. A curved ray, similar to a thin parabolic stream, has been noted on the photographs. A comparison has been made of results obtained with those of radio observation of nonuniformities in the corona. The width of the rays (10^5 km) at a distance of 4 R⊙ from the Moon's limb is in good agreement with the radio-astronomical estimates made by Hewish and Vitkevich. *Subject Heading:* **1. Corona structure.**—*Author's abstract.* Ⓢ

11L–288 523.755:523.037

Bruce, C. E. R. (*Electrical Research Association, Leatherhead*), **Temperatures reached in electrical discharges in the solar atmosphere.** *Nature,* London, 187(4740):865–866, Sept. 3, **1960. DWB**—The author had previously suggested grounds that the electrical discharge theory of solar flares and the associated magnetic storms and aurora would give rise to temperatures of the order of 100,000,000°K somewhere between the Sun and the Earth's orbit. These values have recently been confirmed by U. S. Navy satellite experiments. Similar temperatures are reached in galactic

electric discharges. The only limit to the discharge temperatures of solar jets will be the onset of thermonuclear processes. The main difference between Population I stars and Population II stars is that the former have been subjected to "thermonuclear temperature" of the order of 400,000,000°K for a period of the order of 10–100 million years. *Subject Headings:* **1. Solar atmosphere 2. Solar jets.**—*R.B.* Ⓢ

11L–289 538.56:523.755

Ginzburg, V. L. and Zhelezniakov, V. V. (*both, Radiophys. Res. Inst. Gorki Univ.*), **On the propagation of electromagnetic waves in the solar corona, taking into account the influence of the magnetic field.** *Soviet Astronomy AJ*, New York, 3(2):235–246, March/April **1959.** 5 figs., 14 refs., 24 eqs. **DLC.** Transl. of **O rasprostranenii elektromagnitnykh voln v solnechnoĭ korone pri uchete vliianiia magnitnogo polia,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(2):233–246, March/April **1959. DLC**—The problem of the propagation of electromagnetic waves in the solar corona over a sunspot with a strong magnetic field and also in some other cases is considered. The conditions for the escape of radiation from the corona as a result of the interaction of normal waves and their scattering on fluctuations of the electron concentration are discussed. *Subject Headings:* **1. Electromagnetic wave propagation 2. Corona activity 3. Sunspot magnetism.**—*Authors' abstract.* Ⓢ

11L–290 523.755:523.164.32

Gnevyshev, M. N., **Sviaz' mezhdu opticheskim i radio-izlucheniiami solnechnoĭ korony.** [The relationship between optical and radio emission of the solar corona.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(2):227–235, March/April **1960.** 5 figs., 18 refs., 4 eqs. Russian and English summaries p. 227. Transl. into English in *Soviet Astronomy AJ*, New York, 4(2):217–224, **1960. DLC**—High quality and complete noneclipse observations of the solar corona were collected during the IGY. These made possible comparisons of coronal radiation in λ5305 and meter waves and also geomagnetic disturbances, which are more detailed than those made previously. Conclusions: 1) The intensity of the coronal line λ5305 A has a maximum above sunspots. 2) The best conditions of visibility of coronal details occur a day after their crossing the east limb of the Sun or a day before crossing the west limb. 3) Radio emission during noise storms on meter waves has a narrow directivity (the solid angle is less than 10°), there being a sharp increase in the intensity of λ5305 A in the same place in the corona. 4) A noise storm on meter waves is usually observed 2–4 days before a geomagnetic storm. *Subject Headings:* **1. Coronal emission data 2. Radio emission from sun.**—*Author's abstract.* Ⓢ

11L–291 551.521.67:523.755:523.32

Herring, J. R. and Licht, A. L. (*both, Goddard Space Flight Center*), **The solar wind.** *U. S. National Aeronautics and Space Administration, Technical Note*, D-487, Sept. **1960.** 5 figs., 15 refs., 33 eqs. **DWB, DLC**—Parker's model of a spherically expanding corona, the "solar wind," is compared with D. E. Blackwell's observations of the 1954 minimum equatorial corona. A significant discrepancy is found between the predicted and observed electron densities at distances from the sun greater than 20 solar radii. Blackwell's data are found to be consistent with a model in which the corona expands mostly within a disk less than 25 solar radii thick, lying within the sun's equatorial plane. The thickness of the disk as a function of distance from the sun is qualitatively explained in terms of magnetic pressure. The solar wind is found to have a considerable effect on the lunar atmosphere. First, the calculated density of the lunar atmosphere is greatly reduced by collisions with protons in the solar wind. If the flux particles in this wind has the conventional values ranging between 10^{10} to 10^{11} cm^{-2} sec^{-1}, the calculations yield a lunar pressure of 10^{-13} atmosphere of argon, in agreement with the value predicted by Elsmore and Whitfield on the basis of observations of the occultation of radio stars. Second, following a suggestion by Gold, it was found that the collisions of solar-wind protons with the lunar surface produce an atmosphere of cold neutral hydrogen with a density of $10^5/cm^3$ at the lunar surface. The density falls off at greater distances in accordance with the inverse-square law. Estimates indicate that the interaction of solar particles with the neutral hydrogen will produce an extended lunar ionosphere with a density of the order of 400 protons/cm^3 in the vicinity of the moon. *Subject Headings:* **1. Coronaradiati on 2. Solar corpuscular influences on moon 3. Lunar atmosphere 4. Solar wind.**—*Authors' abstract.* Ⓢ

11L–292 550.388:523.755

Johnson, Francis S. (*Lockheed Missiles & Space Div. Palo Alto, Calif.*), **The gross character of the geomagnetic field in the solar wind.** *Journal of Geophysical Research*, Wash., D. C., 65(10):3049–3051, Oct. **1960.** 2 figs., 7 refs. **DLC**—The effect of a rapidly moving highly conducting solar plasma, or solar wind, on the earth's magnetic field should be to deform it and confine it; it should not be to pull out to infinity magnetic lines of force which otherwise would lie close to the earth. At low latitudes the geomagnetic field is strengthened by the interaction at all distances from the earth out to the confining boundary, beyond which there is solar plasma and not geomagnetic field.

At high latitudes, however, the geomagnetic field is weakened by the confining action of the solar wind. The shape that the deformed geomagnetic field should assume is roughly that of a tear drop; the marked lack of symmetry in the deformed field must be an important factor in space investigations such as measurements of trapped radiation or geomagnetic field. The boundary between the geomagnetic field and the solar plasma should be turbulent; there is a possibility that the presence of the hydromagnetic waves generated by the turbulence will open the tail of the tear drop, thus modifying the confinement of the field by the solar wind. *Subject Headings:* **1. Geomagnetic field 2. Solar wind 3. Solar-terrestrial relationships.**—*Author's abstract.* Ⓢ

11L–293 523.755

Kellog, Paul J. and Ney, Edward P. (*both, School of Physics, Univ. of Minn., Minneapolis*), **A new theory of the solar corona.** *Nature*, London, 183(4671):1297–1301, May 9, **1959.** 3 figs., table, 13 refs., 4 eqs. **DLC**—A new interpretation of the salient properties of solar corona is given, based on the many eclipses that have been observed since 1898. The corona is not merely a gas of electrons and protons with isothermal mixture of heavy elements at a temperature of about a million degrees and remaining in hydrostatic equilibrium in the solar gravitational field; but rather, it consists of trapped charged particles that move in the magnetic fields of the Sun similar to the Van Allen charged particle cloud enveloping the earth. The article explains the observational facts on the scale height of the corona, the ratios between the population of the ionization states of heavy atoms, the Doppler broadening of emission and Fraunhofer lines, as well as the measurement of radio intensity. Facts discussed are consistent with the experimental model and are quite different from the currently accepted ones. *Subject Heading:* **1. Corona theories.**—*N.N.* Ⓢ

11L–294 523.755

Leroy, Jean-Louis (*Observatoire de Meudon*), **Observation d'un jet coronal persistant.** [Observation of a persistent coronal jet.] *Annales d'Astrophysique*, Paris, 23(4):567–573, July/Aug. **1960.** 4 figs., table, 7 refs. French, English and Russian summaries p. 567. **DWB, DLC**—Observations of the solar corona in white and monochromatic light, made with new instruments at Meudon and Pic du Midi Observatories, have shown that a large polar streamer existed during the fall of 1959. It was present during at least three months. Monochromatic emissions appeared only around the bottom of the streamer. *Subject Headings:* **1. Coronal emission lines 2. Coronal streamers 3. Photoelectric polarimeter 4. Meudon Observatory, Paris, France 2. Pic du Midi, France.**—*Author's abstract.* Ⓢ

11L–295 523.755:535.51

Mogilevskiĭ, E. I.; Nikol'skiĭ, G. M. and Nikol'skaia, K. I., **O poliarizatsii emissionnykh linii korony.** [Polarization of coronal emission lines.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(2):236–245, March/April **1960.** 8 figs., 2 tables, 16 refs., 11 eqs. Russian and English summaries p. 236. Transl. into English in *Soviet Astronomy AJ*, New York, 4(2):225–233, **1960. DLC**—Two spectrograms of the corona taken during the eclipse of June 30, 1954 were studied. These were obtained with the ISP-65 prismatic spectrograph (λ6374–125 A per mm, λ5303–51 A/mm). A Wollaston prism was placed behind the slit of the spectrograph, so that spectrograms with mutually perpendicular polarization were obtained simultaneously for the polar and equatorial regions (for heights $\lesssim 0.6 R_\odot$). The method of analysis of the spectrograms is described. The relative brightness of the F- and K-components of the corona was found from the blend Na λ5893 A. For $p = 1.3\ R_\odot$, we found $i_K/(i_K + i_F) = 0.8$, which is in good agreement with the model of the minimum corona. The variation of polarization in λ5303 was determined for the equatorial zone of the corona, and in λ6374 for the polar zone. The polarization found for regions of the continuous spectrum adjacent to these lines is in agreement with data of other authors. The variation of intensity of the lines and the continuous spectrum were also determined. The high degree of polarization in the lines permitted an estimate to be made of the relative importance of photoexcitation and excitation by electron impact for λ5303 and λ6374 at different heights. Experimental values of the mean effective cross section of line excitation by electron impact were derived: $\bar{\sigma}_{5303} = 0.77 \cdot 10^{-17}$ cm², $\bar{\sigma}_{6374} = 0.63 \cdot 10^{-17}$ cm². The value obtained for $\bar{\sigma}_{5303}$ is smaller than that found previously. The results obtained are discussed. *Subject Headings:* **1. Coronal emission lines 2. Polarization of coronal emissions.**—*Authors' abstract.* Ⓢ

11L–296 523.755

Nikol'skiĭ, G. M. (*Acad. Sci., KazSSR*), **The coronal emission line λ5694.** *Soviet Astronomy AJ*, New York, 3(3):466–469, Dec. **1959.** 15 refs. **DLC.** Transl. of **O svechenii korony v linii λ5694,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(3):477–480, May/June **1959. DLC**—Analysis of noneclipse observations of the corona in λ5694 and λ6374 confirms ELWERT'S theory which explains the emission of these lines in the same coronal region as being due to the ionizing action of the hard

radiation of coronal condensations on Ca XI ions in the "red regions" of the corona. The fact that the latter possibility is realized; imposes additional limitations on the choice of the ion giving rise to the λ5694 line. Apparently, EDLEN'S identification of the yellow line with Ca XV is correct. *Subject Heading:* **1. Coronal emission lines.**—*Author's abstract.* Ⓢ

11L–297 523.755

†Saito, Kuniji (*Tokyo Astronom. Obs.*), **Equatorial coronal streamers of the sun.** *Astronomical Society of Japan, Tokyo, Publications*, 11(4):234–252, **1959.** 9 figs., 8 tables, 36 refs., numerous eqs. **DLC**—Long equatorial streamers observed on the solar corona pictures of 1955 eclipse were photometrically investigated. Roots of these streamers, five in all, are identified with the green corona sources (neither with filaments nor spots) on the rotation map of the solar phenomena. Brightness distribution tangential to the streamers can be fitted with the error functions. The half-width increases linearly with the solar distances in the regions of the outer corona. Brightness of the streamers along radial direction was investigated and a model is given after comparison with the previous data. Electron density in the streamers is derived as amounting to about 10^7 per cm^3 at 4 solar radii and 10^3 per cm^3 at the earth's distance. Number of electrons included in the cross-section 1 cm thick was found $1.2 \cdot 10^{34}$. Assuming the equation of continuity, it is concluded that the streamers are accelerated from nearly zero velocity state to about 500 km at the earth's distance. The result is compared with PARKER'S theory. Diffusion velocity in the side way is estimated 10 km/sec at most but probably much less in reality. Influence of the streamers on the earth is also discussed. *Subject Headings:* **1. Corona structure 2. Coronal streamers 3. Solar-terrestrial relationships.**—*Author's abstract.* Ⓢ

11L–298 523.755

Vitkevich, V. V. and Panovkin, B. N. (*both, Acad. Sci., U.S.S.R.*), **On the structure of the nonuniformities of the solar supercorona.** *Soviet Astronomy AJ*, New York, 3(3):529–530, Dec. **1959.** fig., ref. **DLC.** Transl. of **K voprosu o strukture neodnorodnosteĭ sverkhkorony Solntsa,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(3):544–545, May/June **1959. DLC**—On the basis of data of the observations of the occultation of the Crab Nebula by the solar corona, made in July 1957, it is shown that the nonuniformities of the supercorona evidently have the form of elongated streams, the directions of which are mainly radial or nearly radial. Such an orientation of the nonuniformities does not contradict the general idea that the nonuniformities of the supercorona are oriented along the lines of force of the general magnetic field, considered as a dipole. *Subject Headings:* **1. Corona structure 2. Crab Nebula 3. Coronal streamers.**—*Authors' abstract.* Ⓢ

11L–299 523.755

Vitkevich, V. V. (*P. N. Lebedev Physics Inst., Acad. Sci., U.S.S.R.*), **Solar supercorona from the observations of 1951–1958.** *Soviet Astronomy AJ*, New York, 4(1):31–39, July/Aug. **1960.** 6 figs., 19 tables, 6 refs., eqs. **DLC.** Transl. of **Sverkhkorona Solntsa po nabliudeniiam 1951–1958 gg,** *Astronomicheskiĭ Zhurnal*, Moscow, 37(1):32–41, Jan./Feb. **1960. DLC**—The observations of the solar supercorona, made at the Crimean station of the Institute of Physics, Academy of Sciences, U.S.S.R., are summarized. These observations were made on different wavelengths and with different interferometer base lines during 1951–1958. The average properties of the supercorona at the minimum phase of solar activity have been found. During the period of maximum solar activity, the electron density of nonuniformities increases, on the average, by a factor of 2. An increase of the electron density is observed for the outer, as well as the inner regions of the supercorona. The lower limit to the velocity of the plasma ejected from the sun during the period of maximum solar activity, and reaching the outer regions of the supercorona, is 1 km/sec. *Subject Headings:* **1. Corona structure 2. Coronal streamers 3. Crimea.**—*Author's abstract.* Ⓢ

11L–300 523.755:535.33:523.746

Waldmeier, M. (*Eidgen. Sternwarte, Zürich*), **Das Verhalten der monochromatischen Korona im 11 jährigen Zyklus.** [Behavior of the monochromatic corona in the 11-year cycle.] *Zeitschrift für Astrophysik*, Berlin, 50(3):145–154, **1960.** 4 figs., 3 tables, 12 refs. English summary p. 145. **DLC**—The author's coronal measurements at the Arosa Observatory cover two cycles. The present paper deals with the total emission of the coronal lines 5303 and 6374 Å—defined as the sum of all intensities measured along the solar limb at a distance of about ½′—for the years 1939 to 1959. The emission of the line 5303 follows the spot-curve with great amplitude and its extremes coincide with those of the sunspots. The emission of the line 6374 is nearly independent of the phase of the cycle. Its small fluctuations may be described as a double wave, and a maximum of the 6374 emission appears when the spots show either a maximum or a minimum. The pronounced 11-year period of the line 5303 Å is due to the fact that the electron density as well as the temperature are higher during the spot maximum than during the minimum and with their increase the intensity of the line rises

too. On the contrary, as the emission of the line 6374 Å diminishes with increasing temperature, the variations influenced by the density and the temperature almost compensate each other. The small maximum coinciding with the spot maximum is caused by the increased density, that occurring at the same time as the spot minimum by the low temperature. *Subject Headings:* **1. Coronal emission lines 2. Sunspot-coronal relationships 3. Arosa, Switzerland.**—*Author's abstract.* Ⓢ

SPECTRA

See also: **Rocket astronomy** (Friedman), 11L–26; **Experiments from rockets and satellites** (Friedman), 11L–27; **Photoelectric study of sunspots** (Makita, Morimoto), 11L–252; **Spectrographic work at Tromsö and Oslo** (Vegard), 11L–258; **Spectroscopy of solar flares** (Michard et al.), 11L–267; **Emission of Fe I and Ti II in lower chromosphere** (Kawaguchi), 11L 273; **H and K Ca^+ lines in chromosphere and faculae** (Khokhlova), 11L–274; **Excitation of ionized helium in chromosphere** (Namba), 11L 275; **Excitation of oxygen lines in chromosphere** (Nikol'skiĭ), 11L–276; **Spectroscopic observations of corona during eclipse of June 30, 1954** (Baturova et al.), 11L–284; **Identification of Ca XV coronal lines** (Borisoglebskiĭ), 11L–285; **Analysis of emission corona 1942–1955 from Climax spectrograms** (Bretz, Billings), 11L–286; **Polarization of coronal emission lines** (Mogilevskiĭ et al.), 11L–295; **Coronal emission line λ5694** (Nikol'skiĭ), 11L 296; **Monochromatic corona in 11-year cycle** (Waldmeier), 11L–300; **Flash spectrum, eclipse of Oct. 12, 1958** (Suemoto, Hiei), 11L–314; **Determination of abundances** (Pecker), 11L–389.

11L–301 523.77

Lodén, Lars Olof, **Some spectrographic solar observations made in July 1957.** *Arkiv för Astronomi*, Stockholm, 22(22):245–258, **1959.** 12 figs., 3 plates, table, 15 refs. **DLC**—An extensively illustrated paper reporting some spectrographic solar observations in the Hα region on different dates in July 1957. The observations were obtained with the grating spectrograph of the 20-meter horizontal telescope of the Swedish Astrophysical Station on Capri (Italy). Reported and discussed are a flare with surge on July 22, surge like phenomena on July 24, a small flare on July 25, very active group on July 27, and a flare-like object with surge on July 31. *Subject Headings:* **1. Solar spectroscopy 2. Solar phenomena 3. Capri, Italy.**—*I.S.* Ⓢ

11L–302 523.77:523.036.51

Bell, Barbara (*Harvard College Obs., Cambridge, Mass.*) and Meltzer, Alan (*Rensselaer Polytechnic Inst., Troy, N. Y.*), **The Doppler widths of solar absorption lines.** *Smithsonian Contributions to Astrophysics*, Wash., D. C., 3(5):39–46, **1959.** 5 tables, 17 refs., 2 eqs. **DWB, DLC**—In an attempt to distinguish the contributions of turbulence and kinetic temperature to the half-widths of solar absorption lines, photoelectric tracings were made of the profiles of 22 moderately weak lines of three elements covering a wide range in atomic weight (μ): carbon (12), silicon (28), and iron (56). The tracings were analyzed by the method of Voight functions. In iron, to be as nearly comparable as possible with the available lines of silicon and carbon, only lines of relatively high (>4.1 e.v.) excitation potential were used. When the μ-dependent and the μ-independent parts of the Doppler half-widths were separated, a kinetic temperature of the order of 10,000°K was obtained. Temperatures of the same order, or somewhat higher, are indicated if the damping is neglected and the entire half-width is assumed to arise from Doppler broadening. *Subject Headings:* **1. Doppler broadening of solar lines 2. Solar absorption lines.**—*Authors' abstract.* Ⓢ

11L–303 523.774

Dumont, Simone and Pecker, Jean-Claude (*both, Observatoire de Paris-Meudon*), **Profondeur de formation dans le spectre solaire, I, Application à l'inversion de la relation de Laplace.** [Depth of formation in the sun's spectrum, Pt. 1, Application to the inversion of Laplace relation.] *Annales d'Astrophysique*, Paris, 23(4):655–667, **1960.** 6 figs., 3 tables, 6 refs., eqs. French, English and Russian summaries p. 655. **DWB, DLC**—A new method is suggested for the inversion of the relation

$$I_\nu(\mu) = \int_0^\infty S_\nu(\tau) e^{-\tau/\mu} \frac{d\tau}{\mu}$$

using the definition $I_\nu(\mu) = S_\nu[\tau^*(\mu)]$ for the depth of formation τ^*. Tables of τ^* are prepared for three developments of $S(\tau)$. The new method is applied to a test-problem as well as classical methods. The comparison shows the improvement brought about by the new method. Finally, a method is outlined for correcting the residuals: $\Delta I = I_{\text{observed}} - I_{\text{computed}}$. *Subject Heading:* **1. Solar spectrum.**—*Authors' abstract.* Ⓢ

11L–304 535.33:551.521.17 523.775

Athay, R. Grant (*High Altitude Obs., Univ. Colorado*), **The equilibria and ultraviolet spectra of H, He I, and He II in the solar atmosphere.** *Astrophysical Journal*, Chicago, 131(3):705–716, May **1960.** 3 tables, 16 refs., 42 eqs. **DWB, DLC**—The ionization equilibrium equations and source functions for the ions H, He I, and He II are considered under conditions appropriate to the solar chromosphere. The equations are formulated in terms of both occupation numbers and b_k parameters, in order to clarify their relationship to earlier work for H and He I. In the case of the ionization equations for H, somewhat more approximate forms are adopted from those appearing in earlier works, in order to illustrate more clearly the dominant transitions in the equilibrium. The three ions considered here exhibit fundamental differences as well as many similarities in both the ionization equations and the source functions. A consideration of the ultraviolet spectra indicates that the central intensities in the Lyman-β lines are influenced mainly by the "local" value of T_e near the region $r=1$, whereas the central intensities of the Lyman-α lines are influenced by the distribution of T_e throughout a large range in r and cannot be described solely in terms of the "local" value of T_e near $r=1$. For this reason, observations of the Lyman-β profiles and fluxes by means of rockets and satellites become a much more valuable supplement to Lyman-α observations than had previously been supposed. *Subject Headings:* **1. Ultraviolet spectra 2. Chromosphere 3. Ionization equilibrium 4. Solar spectrum.**—*Author's abstract.* Ⓢ

11L–305 523.775.2/5

Divan, Lucienne and Pecker, Charlotte, **Etude des spectres pris par Bernard Lyot à l'éclipse de Khartoum du 28 février 1952.** [Study of the spectra taken by Bernard Lyot during the Khartoum eclipse on Feb. 28, 1952.] *Annales d'Astrophysique*, Paris, 24(4):541–566, July/Aug. **1960.** 6 figs., 2 tables, 18 refs. French, English and Russian summaries p. 541. **DWB, DLC**—Results of the studies of the Lyot spectra taken during the Khartoum eclipse (1952) with a slit spectrograph (6700–4000 Å; 4800–3300 Å). Variation of the coronal line intensities with latitude (Öhman's method). Measurements of equivalent widths for the strongest coronal lines in a coronal condensation. Study of a prominence located on the west limb of the sun during the eclipse: identification, intensities of the emission lines, measurement of the Balmer discontinuity. *Subject Headings:* **1. Solar eclipse, Feb. 1952 2. Coronal emission intensities 3. Solar prominence 4. Khartoum, Egypt. I. Lyot, Bernard.**—*Authors' abstract.* Ⓢ

ECLIPSES

See also: **Spectroscopic observation of corona during eclipse of June 30, 1954** (Baturova et al.), 11L–284; **Structure of far outer corona** (Bronshten), 11L–287; **Optical and radio emission of solar corona** (Gnevyshev), 11L–290; **New theory of solar corona** (Kellog, Ney), 11L–293; **Spectra taken during Khartoum eclipse Feb. 28, 1952** (Divan, Pecker), 11L–305.

11L–306 523.78

Next total solar eclipse. *Sky and Telescope*, N. Y., 18(4):200–201, Feb. **1959.** figs. (incl. photo). **DWB, DLC**—The next total solar eclipse will take place on Oct. 2, 1959. Although observing conditions in the Canary Islands will be best, the path of total Eclipse extends from New England to its termination in the Indian Ocean. The general circumstances are indicated on a map reproduced from the 1959 American Ephemeris and Nautical Almanac. The *U. S. Naval Observatory Circular* No. 78, published July 3, 1957, contains detailed predictions for the path of the total phase in the U. S. The most favorable observation will be possible at Boston, Mass. *Subject Heading:* **1. Solar eclipse, Oct. 1959.**—*E.Z.S.* Ⓢ

11L–307 523.78

Meeus, Jean, **L'éclipse totale de Soleil du 15 février 1961.** [The total solar eclipse of Feb. 15, 1961.] *Ciel et Terre*, Brussels, 76(5/6):166–172, May/June **1960.** 3 figs., table. **DWB, DLC**—A total solar eclipse will take place on Wednesday Feb. 15, 1961. This eclipse is the recurrence of the total eclipse of Feb. 4, 1943 which was invisible in Europe. The author gives a detailed description of the totality zone which will be located in parts of France, Italy and Yugoslavia. The important towns affected by the totality are mentioned. The maximum duration of the total eclipse will be 2m45s (near Rostov). A table includes information on the totality band, between the longitudes $+2°$ and $-22°$. In Belgium, the eclipse will only be partial. *Subject Heading:* **1. Solar eclipse, Feb., 1961.**—*A.V.* Ⓢ

11L–308 523.78

Koeckelenbergh, A.; Meeus, J. and Michel, H., **Observation de l'éclipse totale du Soleil du 15 février 1961.** [Observation of the total solar eclipse of Feb. 15, 1961.] *Ciel et Terre*, Brussels, 76(7/8):209–215, July/Aug. **1960.** 2 figs. **DWB, DLC**—Statement of recommendations for the

observation of the total solar eclipse of Feb. 15, 1961 intended for the members of the Société Belge d'Astronomie, de Météorologie et de Physique du Globe (Belgian Astronomical, Meteorological and Geophysical Society). These instructions concern the site of observation, the ephemerides of the eclipse, the instruments and techniques of observation, the various observations to be made during the eclipse, namely: first and last contact, temperature, illumination, chromosphere, corona, colorimetry, and radio transmission. *Subject Headings:* **1. Solar eclipse, Feb. 1961 2. Eclipse observation instructions.**—*A.V.* Ⓢ

11L–309 523.78

Mikhaĭlov, A. A. (*Main Astronomical Obs., Acad. Sci., U.S.S.R.*), **Solar eclipse of Feb. 15, 1961.** *Soviet Astronomy AJ*, New York, 4(1):64–73, July/Aug. **1960.** 5 tables, map, eqs. **DLC.** Transl. of **Solnechnoe zatmenie 15 fevralia 1961 goda,** *Astronomicheskiĭ Zhurnal*, Moscow, 37(1):67–74, Jan./Feb. **1960. DLC**—Detailed data are given for the track of the total eclipse, from the Balkan peninsula to the eastern end. All data refer to Moscow Standard Time, which is 3 hours ahead of Universal Time. The longitudes are reckoned from the Greenwich meridian eastwards. The differential coefficients A, B, Φ, Λ are used for obtaining data for the total eclipse at points situated within the zone of totality. *Subject Heading:* **1. Solar eclipse, Feb. 1961.**—*Author's abstract.* Ⓢ

11L–310 523.78:778.3 523.755(22/265)

Eclipse photographs from the South Pacific. *Sky and Telescope*, N. Y., 18(6):316–317, April **1959.** photos. **DWB, DLC**—Photographs taken at Suvorov Island during totality show one in which the polaroid filters were placed so the plane of polarization is vertical and the other in which it is horizontal. The conspicuous differences between them demonstrate a marked degree of polarization of coronal light. An interferometer picture of the corona was obtained at Atafu by H. VON KLUBER. A photograph shows the equipment and set-up used by Japanese astronomers at Suvorov Island. The flash spectrum was observed; a small section recorded by the Japanese observers is shown. *Subject Headings:* **1. Eclipse photography 2. Corona radiation 3. Suvorov Island, Pacific Ocean.**—*E.Z.S.* Ⓢ

11L–311 523.78

Kennedy, J. E. (*Defence Research Med. Lab.*), **Eclipse chasing above the clouds.** *Royal Astronomical Society of Canada, Journal*, 53(2):66–73, April **1959.** 2 figs. **DLC**—A report on efforts to photograph the solar eclipse of June 30, 1954 using aircraft. It explains the essential differences in planning the operations of a ground party and those of an airborne expedition for a total solar eclipse. Spectrograms of the light from the crescent were taken at intervals of $1\frac{1}{3}$ seconds, the exposure time for each being $\frac{3}{4}$ of a second. At second contact, the "flash" spectrum of the chromosphere appeared and the record obtained of it is given. The spectrum of the corona, taken during totality on the spectrograph near the back of the aircraft is shown. The search for a daytime display of aurora gave a negative result. *Subject Headings:* **1. Eclipse photography 2. Eclipse observations 3. Solar eclipses.**—*E.Z.S.* Ⓢ

11L–312 523.78

Mitchell, S. A. (*Leander McCormick Obs., Va.*), **Ten total eclipses.** *Royal Astronomical Society of Canada, Journal*, 53(2):49–58, April **1959.** photo., 3 refs. **DLC**—Personal experiences of the author during his efforts to observe and study ten total eclipses are revealed. This report also includes a photograph of the corona taken in 1937 by the U. S. Navy-National Geographic Society Expedition to Canton Island. *Subject Heading:* **1. Eclipse observations.**—*E.Z.S.* Ⓢ

11L–313 551.593.12:523.164.32 523.78

Aarons, Jules; Castelli, John P.; Straka, Ronald M. and Kidd, William C. (*all, A. F. Cambridge Res. Center, Bedford, Mass.*), **Observations on the solar eclipse of Oct. 2.** *Nature*, London, 185(4708):230–231, Jan. 23, **1960.** 4 figs., 2 refs. **DWB**—A preliminary report on the eclipse and scintillation data. Two points are evident from the scintillation records. First—the shadow patterns at 1300 Mc/S and 3000 Mc/S (generated by the radio-frequency active areas on the sun, which, interfering with one another, normally decrease the amplitude of the scintillations) are not dependent on frequency. This point is somewhat at variance with work reported by KAZÈS. Second—within the distance between the centers of the two antennae, a single shadow pattern exists. This latter observation is generally in accord with work of STEINBERG and KAZÈS. *Subject Headings:* **1. Solar eclipse observations 2. Scintillation intensities 3. Radio emission from sun.**—*E.Z.S.* Ⓢ

11L–314 523.78:535.33.018

Suemoto, Zenzaburo and Hiei, Eijiro (*both, Tokyo Astron. Obs.*), **Flash spectrum by the grazing incidence method at the total solar eclipse of October 12, 1958.** *Astronomical Society of Japan, Tokyo, Publications*, 11(2):122–125, **1959.** plate, 3 refs. **DLC**—At the total solar eclipse of Oct.

12, 1958 in the South Pacific a new type of spectrograph was used in order to study both the intensity distributions and the profiles of chromospheric and photospheric lines. This spectrograph is similar to conventional slitless spectrographs normally used for the flash spectrum, but the essential difference is that the grating is used very obliquely. In this way we succeeded in taking flash spectra on which the line profiles are not affected by the extension of the chromosphere and the atmospheric scintillation. *Subject Headings:* **1. Solar eclipse observations 2. Spectrographs.**—*Authors' abstract.* Ⓢ

11L–315 523.78:551.590.24:551.510.535:551.510.62

Malik, Chester; Aarons, Jules and Poeverlein, Hermann (*all AF Cambridge Res. Center, Bedford, Mass.*), **Backscatter experiments during the total eclipse of Oct. 2, 1959.** *Journal of Geophysical Research*, Wash., D. C., 65(10):3241–3247, Oct. **1960.** 5 figs., 7 refs. **DLC**—Backscatter records taken at 19.39 Mc/s with a rotating antenna were investigated in order to determine how the returns were affected by the total eclipse of Oct. 2, 1959. At the frequency chosen, ground backscatter via F-layer reflection sets in before sunrise at the location of observation. On normal days before and after the eclipse, it appears first in the east and south-east and then, 2 or 3 hours later, in the west. On the eclipse day, the signal from the east was delayed several hours and appeared after the return from the west had been received. Graphical representations of details of the backscatter records show not only the eclipse effect but also the effect of ionospheric disturbances on days before and after the eclipse. These disturbances make it nearly impossible to formulate a standard of average behavior that may be quantitatively compared with the eclipse day. The long duration of the eclipse effect indicates its complicated nature which probably involves dynamic properties of the F_2 layer. *Subject Headings:* **1. Eclipse effects on ionospheric reflection 2. Ionospheric radio wave scattering.**—*Authors' abstract.* Ⓢ

11L–316 523.78:551.521.1 551.590.24:551.593.53

Karapiperis, L. N. (*Univ. of Athens, Greece*) and Karapiperis, Ph. P. (*Natl. Obs. of Athens*), **On the variation of solar radiation and blueness of the sky during the eclipse of June 30, 1954 at Athens.** *Geofisica Pura e Applicata*, Milan, 43:323–328, May/Aug. **1959.** 5 figs. English summary p. 323. **DWB, DLC**—This paper presents the study of variations of the solar radiation and the blueness of the sky during the eclipse of June 30, 1954 at Athens. The comparison of the solar radiation march during the eclipse day to that of the two preceding and the two following days of the eclipse—all five days were almost identical from the standpoint of weather—proved that the direct solar radiation and the total (sky and sun) radiation underwent a considerable decrease during the phenomenon. The blueness of the sky also underwent a significant change, especially at the maximum of the eclipse. *Subject Headings:* **1. Eclipse effects on solar radiation 2. Eclipse effects on sky light color 3. Solar radiation variations 4. Athens, Greece.**—*Authors' abstract.*— Ⓢ

11L–317 523.78:551.508.822(512.317)

Apps, R. F., **Results of the experimental radiosonde ascents made at Hong Kong during the solar eclipse April 19, 1958.** *Hong Kong. Royal Observatory, Technical Note*, No. 19, **1959.** 7 p. fig., tables, 3 refs. **DWB**—Data obtained during solar eclipse of April 19, 1958 have been used to investigate the possible effects a shielding of the magnetic circuit might have on temperature at any given level. The report includes a description of the modified instrument, the Kew type radiosonde, the effect of this modification on the normal lag correction, and on the radiation correction at levels below 6.5 km and below clouds. A normal lag correction is usually $-1.1°C$ at the tropopause but with this modification the lag correction is reduced to $-0.2°C$ at all heights up to the tropopause for ascents in daytime. This proves that the temperature of the magnetic circuit lags by 6°C behind that of air at all levels up to the tropopause. In the stratosphere, the applied correction factor becomes a problem and is unsatisfactory. This trial suggests that the modified shield over the magnetic circuit of the temperature element gives more accurate results and should be used in addition to normal lag corrections. *Subject Headings:* **1. Radiosonde correction 2. Hong Kong.**—*N.N.* Ⓢ

STARS

COLOR, RADIATION, MAGNITUDE (GIANT STARS, DWARF STARS)

See also: **Absolute measures of stellar radiation** (Willstrop), 11L–47; **Role of absorption lines in photoelectric photometry** (Rozis-Saulgeot), 11L–65; **Photographic magnitude of faint stars** (Kirillova), 11L–330.

11L–318 523.821.2:523.872

Parenago, P. P. (*P. K. Shternberg Astron. Inst.*), **On the function A(m, C) giving the distribution of stars according to stellar magnitudes and color indices.** *Soviet Astronomy AJ*, New York,

3(1):183–187, Jan./Feb. **1959.** 5 tables, 6 refs., 8 eqs. **DLC.** Transl. of **O funktsii A(m, C), daiushcheĭ raspredelenie zvezd po zvezdnym velichinam i pokazateliam tsveta,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(1):182–186, Jan./Feb. **1959. DLC**—The functions $A(m, C)$ and $\varphi(M, C)$ which give the distribution of stars according to their visual or absolute magnitude and color indices are defined. A formula is derived which predicts the expected number of stars of a given visual magnitude and color index. In this formula $\psi_M(C)$ is the fraction of stars of the given absolute magnitude which have the given values of the color index. In the region of the Orion nebula the spectral classification has been reexamined on an area of $9\square°$ and is complete up to $12^m.5$. The distribution is shown in a table and compared with the normal distribution obtained from the data in the BERGEDORF spectral survey for the latitude of the Orion nebula. Information is obtained on "additional" stars present in the region of the Orion nebula and belonging to the stellar association. The presence in this association of O-B9 and F5-F9 stars is indisputable. AO-A4 and FO-F4 stars are also present but are few in number. There are no (or very few) A5-A9 stars. All this favors a break in the spectrum-luminosity diagram rather than a gradually increasing departure from the usual main sequence. *Subject Headings:* **1. Color of stars 2. Stellar magnitudes.**—*Author's abstract.* Ⓢ

11L–319 523.821.3

Couderc, Paul, (*Observatoire de Paris*), **Observation des galaxies et modèles cosmologiques.** [Observation of galaxies and cosmological models.] *Annales d'Astrophysique*, Paris, 23(3):397–402, May/June **1960.** 7 refs. French, English and Russian summaries p. 397. **DWB, DLC**—The choice between cosmological models depends upon the certainty of the evaluation of apparent and absolute magnitudes of galaxies. After the recent reevaluations of distances, other errors remained: selectivity effects studied by (Miss) E. SCOTT, aberration, absorption and evolution. It is also desirable to replace photographic magnitudes by bolometric measurements. *Subject Headings:* **1. Galactic systems 2. Cosmology 3. Stellar magnitudes.**—*Author's abstract.* Ⓢ

11L–320 535.243:523.823:523.875

Chalonge, D. (*Institut d'Astrophysique, Paris*), **Détermination spectrophotométrique des types, des luminosités et des âges des étoiles.** [Spectrophotometric determination of the types, brightnesses and ages of stars.] *Annales d'Astrophysique*, Paris, 23(3):439–443, May/June **1960.** French, English and Russian summaries p. 439. **DWB, DLC**—In the three dimensional diagram, the coordinates λ_1, and D are independent of interstellar absorption and this fact makes it possible to built directly and without corrections diagrams equivalent to the composite CL diagrams. The position of the stars on the $\lambda_1 - D$ diagram is a function of their age; calibration is made with cluster stars. J. BERGER is studying double stars from the same viewpoint and also for the determination of absolute magnitudes. The continuation of these projects will demand a study of the spectra of faint stars. *Subject Headings:* **1. Spectrophotometric observations 2. Stellar brightness 3. Age of stars.**—*Author's abstract.* Ⓢ

11L–321 523.823:523.852.31

Sobolev, V. V. (*Leningrad State Univ.*), **Brightness of a spherical nebula.** *Soviet Astronomy AJ*, New York, 4(1):1–6, July/Aug. **1960.** fig., 2 refs., 39 eqs. **DLC.** Transl. of **O svechenii sfericheskoĭ tumannosti,** *Astronomicheskiĭ Zhurnal*, Moscow, 37(1):3–8, Jan./Feb. **1960. DLC**—The problem of light scattering in a homogeneous sphere with an energy source in its center is considered, an arbitrary indicatrix of scattering being assumed. An approximate solution of the problem is given. Possible applications to dust nebulae are discussed. *Subject Headings:* **1. Nebulae 2. Scattering of light.**—*Author's abstract.* Ⓢ

11L–322 523.823.4:523.841.37

Kraft, Robert P. (*Calif. Inst. Tech.*), **Color excesses for supergiants and classical cepheids, Pt. 2, The period-color relation for classical cepheids.** *Astrophysical Journal*, Chicago, 132(2):404–416, Sept. **1960.** 10 figs., 4 tables, 19 refs., 4 eqs. **DWB, DLC**—The correlation between spectral type and intrinsic color for F and G supergiants of class Ib that had set up in Paper I is improved slightly, and color excesses of precision (m.e.) ± 0.03 mag. $(B-V)$ are given for 32 classical cepheids. The relation between period and mean color is found to be surprisingly close, especially for cepheids of large amplitude. At a given period, the amplitude of the blue (or visual) light-curve is evidently correlated with the deviation of a cepheid from the period-mean-color relation. A quantity f_B is defined which gives the amplitude of the blue light-curve of a cepheid in terms of the maximum amplitude that has been observed for that period (in the vicinity of the sun). Equations are given for calculating a color excess $E(B-V)$ from the period, the observed mean color, and f_B. It is suggested that f_B (or some equivalent quantity) be used in place of the notation A, B, C. The estimation of excesses from a relation between period and color at maximum light is not recommended. The color excess of β Dor, which is near the Large Magellanic Cloud, is briefly discussed. *Subject Headings:* **1. Color of stars 2. Cepheids.**—*Author's abstract.* Ⓢ

11L–323 523.823.4:523.161

Rublev, S. V., **On the possibility of outflow of matter from super giant stars of late spectral classes.** *Soviet Astronomy AJ*, New York, 3(1):76–87, Jan./Feb. **1959.** 6 tables, 29 refs., 18 eqs. **DLC.** Transl. of **O vozmozhnosti istecheniia materii iz zvezd-sverkhgigantov pozdnikh klassov,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(1):73–84, Jan./Feb. **1959. DLC**—The problem of continuous outflow of matter from stars is considered. A criterion for the polytropic flow of matter constituting the stellar photosphere has been derived. Outflow of matter is characterized by $\alpha \sim 1$, where α is the ratio of current outflow velocity to parabolic velocity. The parameter α can be derived from the observed stellar characteristics. The motion of matter in the reversing layer has also been considered and an approximate condition for the outflow of matter found. A condition for accelerated and decelerated motion was also derived. The main-sequence stars and a Wolf-Rayet star (V 444 Cyg) were studied. Outflow of matter is absent for the first two stars. For the third star outflow with acceleration was found. The derived theoretical velocities of outflow are comparable to those obtained from the emission bandwidths. The sources of continuous absorption in the photospheres of red supergiants were considered and the derived criterion applied to Mira Ceti and α Ori. It is shown that in both cases the photospheres are far from the hydrostatic and turbulent states of equilibrium. It is very probable that the outflow is decelerated. A streaming of matter from the reversing layer is also probable. The velocity of outflow at the photospheric layer is of the order of several tens of km/sec. The annual loss of mass is of the order of $10^{-4}\ \mathfrak{M}\odot$/year. It is shown that such a large loss of mass does not in general contradict the data on the "circumstellar" envelopes surrounding supergiants. *Subject Headings:* **1. Interstellar matter motion 2. Stellar photospheres 3. Supergiant stars.**—*Author's abstract.* Ⓢ

11L–324 523.823.4

†Weymann, Ray (*Princeton Univ., Obs.*), **Coronal evaporation as a possible mechanism for mass loss in red giants.** *Astrophysical Journal*, Chicago, 132(2):380–403, Sept. **1960.** 5 figs., 2 tables, 33 refs., 19 6 eqs. **DWB, DLC**—The consequences of the possible existence of a coronal of a red giant are investigated from a hydrodynamic point of view, under the assumption that deposition of mechanical energy is confined to a narrow layer just above the surface of the star. Because of the energy losses due to radiation, steady subsonic flows do not exist, and only under special circumstances can hydrostatic solutions exist. In contrast, steady supersonic flows can exist, and the mass loss accompanying them would be significant from an evolutionary point of view. However, investigation of the observational consequences rules them out because of the expected presence of lines displaced toward much higher velocities than those actually observed. Other possible models for mass ejection are briefly discussed. *Subject Headings:* **1. Giant stars 2. Stellar mass loss.**—*Author's abstract.* Ⓢ

11L–325 523.823.5

Shatsova, R. B., **Dispersiia logarifmov tangentsial'nykh skorosteĭ zvezd nizhneĭ chasti diagrammy spektr—svetimost'.** [The dispersion of the logarithms of tangential velocities of stars in the lower part of the spectrum—luminosity diagram.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(2): 344–347, March/April **1960.** fig., 2 tables, 12 refs., 4 eqs. Russian and English summaries p. 344. Transl. into English in *Soviet Astronomy AJ*, New York, 4 (2):324–327, **1960. DLC**—It was found that dK to dM and dKe to dMe red dwarfs, white dwarfs and sub-dwarfs exhibit an almost identical dispersion in the distribution of their tangential velocities, $\sigma \approx \pm 0.32$. From the relation $\sigma_v/\bar{v}_t = \sqrt{ae(\sigma^2/\mathrm{Mod}^2) - b}$, where the coefficients a and b depend on σ and are close to unity, we conclude that the ratio of the tangential-velocity dispersion to the mean tangential velocity is constant. *Subject Headings:* **1. Dwarf stars 2. Stellar velocities.**—*Author's abstract.* Ⓢ

MOTIONS

See also: **Perturbations of stellar velocities** (Hénon), 11L–11; **Rotation of polytropic gas sphere** (Porfir'ev), 11L–12; **Radial velocity curve of cepheids** (Aleshin), 11L–333; **Internal motions in a globular cluster** (Oort), 11L–341; **Absolute proper motions of 21 variables** (Artiukhina), 11L–383; **Radial velocity of H II regions in the direction of Sagittarius** (Courtès, Cruvellier), 11L–400.

L11–326 523.832:523.031

†Idlis, G. M., **Sviaz' obshchikh svoĭstv gravitatsionnogo potentsiiala zvezdnykh sistem s obshchim vidom integralov dvizheniia otdel'noĭ zvezdy.** [Relation between general properties of the gravity potential of stellar systems and the general form of integrals of the motion of an individual star.] *Akademiia Nauk Kazakhskoĭ SSR. Astrofizicheskiĭ Institut, Izvestiia*, 8:24–52, **1959.** table, 60 refs., 167 eqs. English summary p. 52. **DLC**—The analysis of a possible quantity and of a

general form of simple motion integrals of an individual star which can serve as independent arguments in a phase density of a stellar system, showed that for a general case three such integrals may be used. The first is an energy integral which is bound with the stability of a system; the second is a moment integral, it guarantees a rotation symmetry of a system and permits its differential axial rotation; and the third has a rather arbitrary form, but ensures a three axial distribution of stellar peculiar velocities and a symmetry of a system relative to an equatorial plane, where a gravitational potential comes to a generalized Parenago formula in the first approximation. *Subject Heading:* **1. Stellar motions.**—*Author's abstract.* Ⓢ

11L–327 523.832:523.852.21

Artiukhina, N. M. and Karimova, D. K. (*both, P. K. Shternberg State Astron. Inst.*). **The meridian proper motions of 161 stars in the region of the belt of Orion.** *Soviet Astronomy AJ*, New York, 3(1):123–130, Jan./Feb. **1959.** fig., 2 tables, 5 refs. **DLC.** Transl. of **Meridiannye sobstvennye dvizheniia 161 zvezdy v oblasti poiasa Oriona,** *Astronomicheskii Zhurnal*, Moscow, 36(1): 121–128, Jan./Feb. **1959. DLC**—Meridian proper motions are determined for 161 stars in the neighborhood of the belt of Orion of spectral classes O to A0, with a probable error not exceeding $\pm 0''.010$. 140 stars are selected, the proper motions of which, contained in the present work, in P. I. Bakulin's work and in the GC, are determined with a probable error $\leqslant \pm 0''.006$, and these, according to P. P. Parenago's work, may be considered probable members of the Orion association. Taking the distance to the association as 400 pc, dispersions of proper motions and tangential velocities along each coordinate are obtained. The dispersion of tangential velocities along both components totals 8–9 km/sec. This value is in good agreement with the value for the dispersion of radial velocities of 9.4 km/sec obtained from the radial velocities of 40 of the stars under consideration which are contained in Wilson's catalog with a characteristic of accuracy of *a* or *b*. *Subject Headings:* **1. Stellar clusters 2. Proper motions of stars.**—*Authors' abstract.* Ⓢ

11L–328 523.832:523.8

Merrill, Paul W. (*Mt. Wilson and Palomar Obs.*), **Motions in stellar atmospheres.** *Astronomical Society of the Pacific, San Francisco, Publications*, 71(421):292–300, Aug. **1959.** 2 tables, 12 refs. **DLC**—An interesting paper dealing with motions in stellar atmosphere. First a brief descriptive outline of the diverse types of atmospheric motions is presented. Motions connected with radiation in the atmosphere and those of material particles are discussed and tabulated. This is followed by a short discussion of certain problems of discrete velocities. *Subject Heading:* **1. Stellar atmospheres.** —*I.S.* Ⓢ

VARIABLE, NEW, DOUBLE STARS

See also: **Variables of the RW Aur type** (Artiukina), 11L–383.

11L–329 523.84.035.9:523.877

†Zhevakin, S. A. (*Gor'kii State Univ.*), **On the pulsational theory of stellar variability, Pt. 5, Multilayer spherical discrete model.** *Soviet Astronomy AJ*, New York, 3(3):389–403, Dec. **1959.** 3 figs., 6 tables, 31 refs., 10 eqs. **Pt. 6, A unified interpretation of various types of variability.** *Ibid.*, 3(6):913–922, May/June **1960.** 3 figs., 39 refs. Transl. of **K teorii pul'satsionnoĭ zvezdnoĭ peremonnosti. V. Mnogosloinaia sfericheskaia diskretnaia model',** *Astronomicheskii Zhurnal*, Moscow, 36(3):394–409, May/June **1959. VI. Edinaia interpretatsiia razlichnykh tipov peremennosti,** *Ibid.*, 36(6):996–1006, Nov./Dec. **1959. DLC**—In Pt. 5 the author presents a theory of the excitation of stellar pulsations by the zone of critical He II ionization, based on the use of the multilayer spherical discrete model. In addition to the greater number of layers used, the computational methods of this paper differ from those previously discussed in that the influence of the temperature-gradient variations on the magnitude of the energy flux in the envelope during pulsations and the sphericity of the stellar envelope are taken into account. The influence of the parameters of the stellar envelope on the amplitude and phase of the oscillations of the radiation flux escaping from the star is investigated. In Pt. 6 a unified interpretation of the main types of stellar variability is attempted. It is based on the numerical results obtained for the nonadiabatic linear oscillations of a four-layer discrete spherical model of stellar envelope with a helium abundance of 14.3% by number of atoms. *Subject Headings:* **1. Stellar spectra 2. Stellar pulsations 3. Stellar variability.**—*E.K.* Ⓢ

11L–330 523.841.1:523.821.3

Kirillova, T. S., **Photographic magnitudes of faint stars in the region of σ and ζ Orionis.** *Soviet Astronomy AJ*, New York, 3(4):665–671, Jan./Feb. **1960.** fig., table, 4 refs., 4 eqs. **DLC.** Transl. of **Fotograficheskie zvezdnye velichiny slabykh zvezd, raspolozhennykh v okresnosti σ i ζ Orionis.** *Astronomicheskii Zhurnal*, Moscow, 36(4):682–689, July/Aug. 1959. **DLC**—The photographic

magnitudes of about 300 faint stars ($\sim 13^m5$–17^m0) in the region of ζ and σ Orionis have been determined. This region of the sky is rich in stars with Hα emission, and probably, variable stars. Photographic stellar magnitudes of faint stars in this region can be used to study the variability of such stars. Using the methods of mathematical statistics some conclusions have been drawn concerning the presence of variable stars among the stars investigated in the present work. *Subject Headings:* **1. Variable stars 2. Photographic stellar magnitudes.**—*Author's abstract.* Ⓢ

11L–331 523.841.11

Pottasch, Sutart R. and Varsavsky, Carlos M. (*both Harvard College Observatory*), **The spectrum of RR Telescopii between May 1949 and August 1950.** *Annales d'Astrophysique*, Paris, 23(4): 516–527, July/Aug. **1960.** 6 tables, 3 refs., French, English and Russian summaries p. 516. **DWB, DLC**—The observations of the slow nova RR Telescopii just before, during, and just after its light maximum in 1949 are presented in detail. *Subject Headings:* **1. Stellar spectra 2. Novae.**—*Authors' abstract.* Ⓢ

11L–332 523.164.42:523.841.12

Shklovskiĭ, I. S., **O prirode Sverkhnovykh zvezd.** [On the nature of supernovae.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(3):369–370. May/June, **1960.** table, 21 refs., 3 eqs. Russian and English summaries p. 369–370. Transl. into English in *Soviet Astronomy AJ*, New York, 4(3): 355–364, Nov./Dec. **1960. DLC**—A method has been developed for the dtermination of individual distances to expanding radio nebulae—remnants of outbursts of type II supernovae—on the basis of the regularity in the decrease of their surface brightness. The analysis of the space distribution of type II supernovae, obtained by using this method, shows that they form an exceedingly flattened system wholly similar to the system of O-B type stars. In separate cases (e.g. in Velorum) associations of radio nebulae, coinciding with associations of hot stars, are observed. On the basis of an analysis of the frequency of outbursts of type II supernovae, the observed exceedingly large masses of the ejected envelopes and the space distribution of the remnants of outbursts, it is concluded that an essential, if not predominant, fraction of O-B type stars should finish their evolution as type II supernovae. The kinetic energy of envelopes of type II supernovae reaches 10^{51}–10^{52} ergs, while that of type I supernovae is less by a factor of 10^3–10^4. The envelopes of the supernova 1572 and apparently 1604 have already essentially retarded, therefore their masses are $M \sim 10^{-2}$–$10^{-3}\ M\odot$. For type I supernovae the ratio of energy emitted during the outbursts to the kinetic energy of the envelope is larger by a thousand times compared to Supernovae of type II. *Subject Headings:* **1. Supernovae 2. Nebular radio sources.**—*Author's abstract.* Ⓢ

11L–333 523.841.37:523.874

†Aleshin, V. I. (*Gor'kiĭ Univ.*), **On the asymmetry of the radial velocity curve of cepheids.** *Soviet Astronomy AJ*, New York, 3(3):458–465, Dec. **1959.** 2 figs., 2 tables, 35 refs., 16 eqs. **DLC.** Transl. of **Ob asimmetrii krivoi radial'nykh skorosteĭ u tsefeid,** *Astronomicheskiĭ Zhurnal*, Moscow 36(3):468–476, May/June **1959. DLC**—The form of pulsation of stars with a high concentration of mass toward the center is investigated using the discrete model. It is shown that the asymmetry of the pulsations is determined firstly by the change in the compressibility of the gas as its density changes, and secondly, by the rate of change of the gravitational energy on compression. On the basis of a numerical integration of the equations of motion of a discrete five-layer model, it is shown that the skewness of the curve representing the radial velocity as a function of time is in good agreement with the observed curve, if the semiamplitude of the pulsation does not exceed 6% of the stellar radius. *Subject Headings:* **1. Stellar pulsations 2. Cepheids 3. Radial velocities.**—*Author's abstract.* Ⓢ

11L–334 523.841.374.2:523.875/7

Oke, J. B. and Bonsack, S. J. (*both, Calif. Inst. Tech.*), **An analysis of the absolute energy distribution in the spectrum of RR Lyrae.** *Astrophysical Journal*, Chicago, 132(2):417–429, Sept. **1960.** 7 figs., 3 tables, 16 refs., 5 eqs. **DWB**—The absolute energy distribution in the spectrum of RR Lyrae has been measured at all phases with the photoelectric spectrum-scanning instrument at Mount Wilson. High-dispersion spectra have been employed to correct the low-resolution scans so that the energy distributions represent the continuous spectrum. Comparisons of these absolute energy distributions with fluxes computed from model atmospheres yield effective temperatures which range from 5900° to 7200°K and effective gravities which vary from 80 to 4000 cm/sec^2. The derived effective gravities agree well with those predicted by a proper combination of the mechanical accelerations obtained from the radial-velocity curve and a real gravity of 475 cm/sec^2 at maximum radius. A somewhat sophisticated application of Wesselink's method for determining radii of variable stars yields a maximum radius of 8.3 ± 0.7 solar radii. The absolute visual magnitude at maximum radius (phase 0.40) is -0.1 with a mean error of 0.2. The loop observed in the $U-B$

versus $B-V$ diagram can be explained entirely by the change in the effective gravity caused primarily by the mechanical acceleration. *Subject Headings:* **1. Stellar spectra 2. Photoelectric spectrometers.**—*Authors' abstract.* Ⓢ

11L–335 523.842.2/3

Kreiken, E. A. and Sner, B. (*Astron. Inst., Univ. of Ankara*), **Note on the H-R diagram of binary stars.** *Annales d'Astrophysique*, Paris, 23(4):528–540, July/Aug. **1960.** 3 figs., 10 refs., 4 tables. French, English and Russian summaries p. 528. **DWB, DLC**—An attempt is made to determine the evolutionary tracks of stars from the distribution in the H-R diagram of the components of binary stars of which the less massive are on the main sequence. Only some envelopes can be constructed to which these evolutionary tracks should be tangent. The shapes of these envelopes suggest that with the early stars the tracks are horizontal, while with the late stars steep tracks prevail. This would be in accordance with theory, but the observational evidence is not conclusive. An inspection of possible evolutionary tracks for individual components with well determined masses leads to controversial results. *Subject Heading:* **1. Binary stars.**—*Authors' abstract.* Ⓢ

STELLAR CLUSTERS

See also: **Local supercluster of galaxies** (de Vaucouleurs), 11L–373; **Galaxies of the Virgo cluster** (Liller), 11L–374; **Gravitational contraction times of stars in very young clusters** (Varsavsky), 11L–387.

11L–336 523.851

Hénon, M. (*Institut d'Astrophysique, Paris*), **L'évasion des étoiles hors des amas isolés.** [Star escapes from isolated clusters.] *Annales d'Astrophysique*, Paris, 23(4):668–677, July/Aug. **1960.** fig., 12 refs., eqs. French, English and Russian summaries p. 668. **DWB, DLC**—It is shown that the escape of a star from an isolated cluster can occur only as the result of a close encounter which causes an abrupt increase in energy. The rate of escape is recalculated (formula 19); the result is about 100 times smaller than the classical value. Escape is negligible in globular clusters, and insufficient to cause the disappearance of galactic clusters. However these results do not take into account the galactic field, and they should be reconsidered in this light. *Subject Headings:* **1. Star escapes 2. Stellar clusters 3. Galactic clusters.**—*Author's abstract.* Ⓢ

11L–337 523.851.2

†Artiukhina, N. M. and Kholopov, P. N. (*both, Astron. Inst. Acad. Sci. U.S.S.R.*), **Distribution of stars in the region of the double stellar cluster *h* and χ Persei.** *Soviet Astronomy AJ*, New York, 3(6):923–936, May/June **1960.** 8 figs., 2 tables, 23 refs. Transl. of **Raspredelenie zvezdnoĭ plotnosti v raĭone dvoĭnogo zvezdnogo skopleniia *h* i χ Perseia,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(6): 1007–1021, Nov. Dec. **1959. DLC**—The apparent density distribution of stars to $16^m.5$ has been studied in the region of the double cluster h and χ Persei. The boundaries of the double cluster found from star counts are presented. The analysis of the distribution of interstellar light absorption shows that the observed dimensions, shape, and structure of the system are not essentially distorted by absorption. The cluster has a double nucleus (h and χ Persei) surrounded by an extensive halo, the density of which is almost constant. The largest diameter is 75 parsecs ($1^\circ.8$); the smallest is 50 pc. The structure of each component of the double nucleus is similar to that of the nucleus of the M 37 cluster. The inner zones of the two nuclei do not touch. The density gradient in the outer zone of each nucleus is one order of magnitude smaller than that in the inner zone. The radius of each nucleus is 12 pc. The boundaries of the different zones of the cluster are sharply defined; the dimensions of the zones are the same for all the B-type stars considered, and do not depend on their absolute magnitudes, which vary within a range of 9^m. In the system, no indications of an equipartition of energy between its members are observed. *Subject Heading:* **1. Stellar clusters.**—*Authors' abstract.* Ⓢ

11L–338 523.851.2

Hodge, Paul W. (*Harvard Coll. Obs.*), **Studies of the Large Magellanic Cloud, Pt. 2, The globular cluster NGC 1846.** *Astrophysical Journal*, Chicago, 132(2):341–345, Sept. **1960.** 3 figs., 2 tables, 12 refs. **Pt. 3, The globular cluster NGC 1978,** *Ibid.*, p. 346–350. 4 figs., 2 tables, 12 refs. **Pt. 4, The globular cluster anonymous 4,** *Ibid.*, p. 351–353. 2 figs., 2 tables, 6 refs. **DWB, DLC**—Two-color photometry of stars in NGC 1846, a globular cluster of the Large Magellanic Cloud, provides a color-magnitude diagram. The branch of the cluster is similar to that of NGC 6356, a globular of our Galaxy which has an unusually high abundance of metals. The absolute magnitudes of the giant branches in these two clusters do not agree, however, probably because of a difference in age, the

Large Cloud cluster being the younger. The color-magnitude diagram for the brightest stars of the cluster NGC 1978 indicates that it is similar to NGC 1846, another cluster in the Large Magellanic Cloud. The slope of the giant branch is gentle, suggesting a relatively high metals abundance. The giant branch is uniformly 0.3 mag. fainter than that of NGC 1846 but is slightly brighter than that of NGC 361, in the Small Magellanic Cloud. A variable star which is probably a member of the cluster may be a W Virginis star with a period of about 20 days. Colors and magnitudes for all stars brighter than $V=18.2$ show that the inconspicuous cluster, Anonymous 4, of the Large Magellanic Cloud is a globular cluster with a very small population of stars. Otherwise its characteristics resemble those of the nearby globular clusters NGC 1978 and NGC 1846. The slope of its giant branch is less steep than that of M3. *Subject Headings:* **1. Galactic clusters 2. Stellar photometry 3. Magellanic clouds.**—*Author's abstract.* Ⓢ

11L–339 523.851.2

Idlis, G. M. and Nikol'skiĭ, G. M. (*both, Acad. Sci., Kazakh SSR*), **The diffuse medium in globular clusters.** *Soviet Astronomy AJ*, New York, 3(4):652–659, Jan./Feb. **1960.** Fig., 27 refs., 32 eqs. **DLC.** Transl. of **Diffuznaia sreda v sharovykh zvezdnykh skopleniiakh,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(4):668–676, Jul./Aug. **1959. DLC**—On the dense stellar background of the central part of the globular cluster M4 (photograph of the Palomar atlas) the authors detected clearings which, judging from probability counts, are not accidental interstellar gaps but screening clouds of a diffuse medium. The parameters of these clouds have been estimated: radius $r\simeq1\overset{p}{.}8 \simeq0.02$ *pc*, optical thickness $r\simeq3$, mass of the dust $m_d\simeq0.001$ $M_\odot$, total mass of the cloud $m\simeq0.1$ $M_\odot$, hydrogen concentration in the cloud $n_H\simeq10^5$ cm^{-3}. The total number of clouds $N\simeq140$. Observations of polarization in the visual spectral region and monochromatic emission at $\lambda=21$ cm of these clouds of the diffuse will be made. *Subject Heading:* **1. Stellar clusters.**—*Authors' abstract.* Ⓢ

11L–340 523.851.2

Limber, D. Nelson and Mathews, William G. (*both, Yerkes Obs.*), **The dynamical stability of Stephan's Quintet.** *Astrophysical Journal*, Chicago, 132(2):286–305, Sept **1960.** 6 tables, 18 refs., 25 eqs. **DWB, DLC**—The dynamical stability of the compact group of galaxies known as Stephan's Quintet has been re-examined. Estimates for the masses of the members of this group have been derived from their luminosities and from what appear to be the best available estimates for their mass-to-light ratios. Strong indications are found that the five members are all highly luminous. It follows that their masses, too, are probably significantly larger than those of average galaxies. Estimates for the internal kinetic and potential energies of the quintet have been derived on the tentative assumption that no significant fraction of the total mass of the cluster is in the form of intergalactic matter. These results have been used in applying the virial theorem to the group. When account is taken of the uncertainties in the projection factors and in the observed radial velocities, it is shown that one is by no means driven to the conclusion that the virial theorem appropriate to a cluster in dynamical equilibrium is violated and that Stephan's Quintet is rapidly disrupting. Further, the observations strongly suggest that two of the members of the group form a double galaxy within the larger structure of the quintet. If this is the case, then there is strong and independent support for the view that the virial theorem as applied to this group is satisfied to at least a reasonable approximation and that Stephan's Quintet is therefore in, or near, dynamical equilibrium and is not disrupting significantly in a time scale of a billion years. *Subject Headings:* **1. Galactic clusters 2. Stephan's Quintet.**—*Authors' abstract.* Ⓢ

11L–341 523.851.2:523.874

Oort J. H. (*Leyden Observatory*) and Van Herck (*U. S. Naval Observatory*), **Internal motions and density distribution in a globular cluster.** *Annales d'Astrophysique*, Paris, 23(3):375–378, May/June **1960.** eqs. French, English and Russian summaries p. 375. **DWB, DLC**—The authors describe a model of the globular cluster Messier 3. The mean velocity of the stars should be of the order of 2.9 km/sec. One should attempt to measure such radial velocities with the new techniques in order to test the theory. *Subject Headings:* **1. Stellar clusters 2. Stellar velocities 3. Radial velocities.**—*Authors' abstract.* Ⓢ

11L–342 523.851.3:523.82

Barkhatova, K. A. and Driakhluchina, L. I., **Rasseiannoe zvezdnoe skoplenie NGC 1513.** [The open cluster NGC 1513.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(2):332–335, March/April **1960.** 3 figs., table, 12 refs. Russian and English summaries p. 332. Transl. into English in *Soviet Astronomy AJ*, New York, 4(2):313–316, **1960. DLC**—The open cluster NGC 1513 was studied. The color-magnitude diagram was constructed for the cluster stars. The distance ($r=860$ *pc*) and the angular and linear diameters ($d=14'$, $D=3.7$ *pc*) were determined. *Subject Headings:* **1. Stellar clusters 2. Color of stars.**—*Authors' abstract.* Ⓢ

11L–343 523.851.3:523.82

Kirillova, T. S., **Statisticheskiĭ analiz diagrammy tsvetsivimaia zvezdnaia velichina rasseiannogo skopleniia IC 1805.** [A statistical analysis of the color-magnitude diagram of the open cluster IC 1805.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(2):327–331, March/April **1960.** 4 figs., table, 3 refs., 5 eqs. Russian and English summaries p. 327. **DLC.** Transl. into English in *Soviet Astronomy AJ*, New York 4(2):308 312, **1960. DLC**—Diagrams of CI vs. m_{ph} for the central region of the open cluster IC 1805 and its vicinity are compared by the methods of mathematical statistics. The known data for the cluster do not permit a differentiation of cluster stars from those of the surrounding field, hence the cluster diagram may be studied only by comparing diagrams of CI vs. m_{ph} constructed for the center of the cluster and for the surrounding stellar background. The distribution of stars on the CI vs. m_{ph} diagrams for the cluster center and for the background is represented by an approximately normal two-dimensional distribution, the parameters of the distributions in each coordinate are computed, and a comparison is made. It is shown that, with this method of constructing the cluster diagram, the difference between it and that of the background is most clearly displayed in the discrepancy between the parameters characterizing the distribution of stars according to color on these diagrams. The values of CI and m_{ph} for the diagram of the cluster center are more closely correlated than those for the diagram of the stellar background. *Subject Headings:* **1. Stellar clusters 2. Color of stars.**—*Author's abstract.* Ⓢ

11L–344 523.851.3:523.875

Kotok, E. V., **K voprosu ob interpretatsii diagrammy spektr—svetimost' dlia Pleiad.** [On the interpretation of the spectrum—luminosity diagram for the pleiades.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(3):492–495, May/June **1960.** 2 figs., table, 7 refs. Russian and English summaries p. 492. **DLC**—The evolutionary curves for gravitational contraction, obtained by HENYEY, LELEVIER and LEVEE, and the spectrum-luminosity diagram for Pleiades, found by MITCHELL and JOHNSON, were reduced to one $Sp - M_v$ system. The results confirm the hypothesis that late spectral type stars are still in the stage of gravitational contraction. Evolutionary computations for the hottest stars of the cluster, assuming variable mass, lead to a life-time of the same order (10^7 years) as that for the evolution of late spectral type stars. A more precise determination is made of the left end of the initial main sequence obtained by JOHNSON. *Subject Headings:* **1. Stellar spectra 2. Pleiades 3. Stellar evolution.**—*Author's abstract.* Ⓢ

11L–345 523.851.3/4

Sharov, A. S. (*P. K. Shternberg State Astron. Inst.*), **The spatial structure of several clusters of galaxies.** *Soviet Astronomy AJ*, New York, 3(5):784–792, March/April **1960.** 4 figs., 3 tables, 14 refs. Transl. of **Prostranstvennaia struktura neskol'kikh skopleniĭ galaktik**, *Astronomicheskiĭ Zhurnal*, Moscow, 36(5):807–815, Sept./Oct. **1959. DLC**—The spatial structure of clusters of galaxies in the constellations Coma Berenices, Cancer and Hydra is considered. The counts of galaxies published by ZWICKY and the method elaborated by P. N. KHOLOPOV were used for the analysis. It was found that according to the distribution of bright members all the considered clusters show a division into three zones: nucleus, zone of constant density and corona. The density gradient changes by about one order from one zone to another. Zonal structure for the faint members is not so well defined. The distribution of galaxies in clusters is not similar to the density distribution in isothermal gas spheres, as was assumed by ZWICKY. The general features of the spatial structure of globular clusters and of clusters of galaxies are very similar. Conclusions are made assuming that the data obtained by ZWICKY have no systematic errors, that the positions of the centers of the clusters are correct and that the clusters are spherical. *Subject Heading:* **1. Galactic clusters.**—*Author's abstract.* Ⓢ

NEBULAE

See also: **Nebular photometry** (Seaton), 11L–45; **Magnetized clouds of interstellar gas** (Getmantsev), 11L–107; **10 cm radiation of Crab nebula** (Kuz'min, Udal'stov), 11L–112; **Brightness of a spherical nebula** (Sobolev), 11L–321; **Emission from nebulae 1225–1350 A** (Shklovskiĭ), 11L–391.

11L–346 523.852:551.510.62:523.164

Ikhsanov, R. N., **Tumannosti IC 1318 a, b, c i mezhzvezdnoe pogloshchenie.** [The nebulae IC 1318 a, b, c and interstellar absorption.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(2):275–280, March/April **1960.** fig., 11 refs. Russian and English summaries p. 275. Transl. into English in *Soviet Astronomy AJ*, New York, 4(2):258–263, **1960. DLC**—Absorption studies made in the region of IC 1318 on both stars and bright nebulae show that the true distribution of surface brightnesses in emission nebulae is drastically distorted by the absorbing matter projected on them. The "illuminated screen" method was employed in studying the absorbing matter. The dark nebulosity

closest to us is the most powerful absorber, with a dust density not lower than $5 \cdot 10^{-24}$ g/cm^3. The true measure of emission in the region lying between IC 1318a and IC 1318b is about 4000, i.e., a connection between these bright nebulae is entirely possible. The mean extinction in the region studied, found from data pooled from observations in H_α, and radio frequencies, is $A_V = 1^m8$. *Subject Headings:* **1. Nebulae 2. Absorption of radio waves 3. Interstellar absorption.**—*Author's abstract.* Ⓢ

11L–347 523.852.2 523.164.43

Aller, H. L. (*Ann Arbor, Michigan*). **Programs for studies of galactic nebulae in the radio-frequency and optical regions.** *Annales d'Astrophysique*, Paris 23(3):331–334, May/June **1960.** plate. French, English and Russian summaries p. 331. **DWB, DLC**—The author describes the program of the new radio-telescope at the University of Michigan, associated with a Curtis-Schmidt telescope. Isophotic contours of diffuse nebulae in ultraviolet, optical and radio frequencies are compared. *Subject Headings:* **1. Radio astronomy 2. Radio telescopes 3. Galactic radio noise 4. Galactic structure.**—*Author's abstract.* Ⓢ

11L–348 523.852.2

Rostovskaia, A. A., **O tipakh "golubykh galaktik."** [Types of blue galaxies.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(3):439–442, May/June **1960.** Table, 3 refs. Russian and English summaries p. 439. Transl. into English in *Soviet Astronomy AJ*, New York, 4(3):418 421, Nov./Dec. **1960. DLC**—The magnitudes and types of Haro's blue galaxies were estimated using the Palomar Sky Atlas. The results are tabulated, the columns designating as follows: 1—the number according to Haro, 2—the number of the Palomar chart, 5—photographic magnitude, then the type, dimension of the galaxy, dimension of the nucleus and the colour characteristic according to Haro. Only a few galaxies belong to types *I* and *Sc*. The majority of the galaxies, as can be seen from the table, belong to types $E-Sa^-$. Evidently most of Haro's blue galaxies belong to early peculiar types with strong emission bands, although judging from their colour, they should belong to later types. A check-up of the results on the negatives is desirable, as the images on the charts are overexposed. *Subject Heading:* **1. Galactic nebulae.**—*Author's abstract.* Ⓢ

11L–349 523.852.21

Dokuchaeva, O. D. (*P. K. Shternberg State Astron. Inst.*), **Determination of the mass of the Orion nebula from photographs taken in red light.** *Soviet Astronomy AJ*, New York, 3(3):451–457, Dec. **1959.** 4 tables, 16 refs. **DLC.** Transl. of **Opredelenie massy tumannosti Oriona po snimkam v krasnoĭ oblasti spektra,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(3):461–467, May/June **1959. DLC**—The energy density $E_n\lambda$ of the Hα radiation from the Orion nebula has been estimated in absolute units (erg/cm^2·sec·sterad) using four photographs of the nebula which were obtained by the author in 1954, using the 25-cm Maksutov telescope at the Shternberg Astronomical Institute, and by G. A. Manova in 1955, using the 50-cm Maksutov telescope at the Mountain Astrophysical Observatory of the Acad. of Sci., Kazakh S.S.R. Calculations have been carried out for three concentric regions of the nebula whose dimensions were 55, 260 and 430 sq min of arc, respectively. The values of $E_n\lambda$ averaged over each region were found to be $2.23 \cdot 10^{-2}$, $6.26 \cdot 10^{-2}$, and $5.06 \cdot 10^{-3}$ erg/cm^2·sec·sterad, respectively. The mean electron densities n_e and masses M were calculated assuming that the nebula has a spherical form, and also that it is a plane formation. Under the first of these assumptions, the values of n_e were found to be $1.3 \cdot 10^3$, $4.7 \cdot 10^2$, and $3.7 \cdot 10^2$ electrons/cm^3, and the masses 16.57 and 96 in units of the solar mass. Under the second assumption, the masses were found to be smaller by a factor of 1.5–2. A comparison with published results (14,15) showed that the data on the hydrogen densities obtained in the present work are in good agreement with those found in (14,15). A discussion is given of the mass of nebula as calculated in the present work. *Subject Headings:* **1. Nebulae 2. Astrophotography 3. Orion.**—*Author's abstract.* Ⓢ

11L–350 523.852.21

Manova, G. A. (*P. K. Shternberg State Astron. Inst.*), **New emission stars in the constellation Orion.** *Soviet Astronomy AJ*, New York, 3(1):188–192, Jan./Feb. **1959** 3 figs., 3 tables, 3 refs. **DLC.** Transl. of **Novye emissionnye zvezdy v sozvezdii Oriona,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(1):187–189, Jan./Feb. **1959. DLC**—A list is given of 32 stars with a bright Hα line in their spectra which were discovered in the HII region near λ Orion photographs taken with a prism objective attached to the 70-cm meniscus telescope of the Abastuman Observatory. Together with those discovered earlier (1, 2) these stars form an extended system with two condensations: one in the region of CO Ori and the other in the region of the emission nebula S 280 near FU Ori. *Subject Headings:* **1. Nebulae 2. Orion.**—*Author's abstract.* Ⓢ

11L–351 523.852.22:535.24

Efimov, Iu. S. (*P. K. Shternberg State Astron. Inst.*), **Photometry of the planetary nebula NGC 7293 (Helix).** *Soviet Astronomy AJ*, New York, 3(3):447–450, Dec. **1959.** fig. table, 11 refs.,

7 eqs. **DLC.** Transl. of **Fotometriia planetarnoĭ tumannosti NGC 7293 (Kheliks)**, *Astronomicheskiĭ Zhurnal*, Moscow, 36(3):457–460, May June **1959.** **DLC**—A photometric study was made of the planetary nebula NGC 7293, near the $H\alpha$ line. A chart of isophotes was plotted, and an estimate was made of the electron concentration and the mass of the nebula. *Subject Headings:* **1. Planetary nebulae 2. Photometric observation techniques.**—*Author's abstract.* Ⓢ

11L–352 523.852.22:535.34

Nikitin, A. A. (*Leningrad State Univ.*), **The investigation of the lines of heavy elements in the spectra of planetary nebulae.** *Soviet Astronomy AJ*, New York, 3(5):759–764, March/April **1960.** table, 8 refs., 8 eqs. Trans. of **K probleme issledovaniia linii tiazhelykh elementov v spektrakh planetarnykh tumannosteĭ**, *Astronomicheskiĭ Zhurnal*, Moscow, 36(5):778–784, Sept./Oct. **1959.** **DLC**—The NIII recombination spectrum of planetary nebulae is analyzed. The occupation of the different levels of the electron configurations $1s^22s2p+(3s,3p,3d,4p)$ and $1s^22s^2+(3s,3p,3d\ .\ .\ .)$ of NIII is studied qualitatively. The NIII ionization due to the ejection of the outer $2p$ and inner $2s$ electrons in planetary nebulae is studied. *Subject Headings:* **1. Planetary nebulae 2. Stellar spectroscopy.**—*Author's abstract.* Ⓢ

11L–353 523.852.22:523.164.4

Moroz, V. I., **Potok ot Krabovidnoĭ tumannosti v $\lambda 2\mu$ i nekotorye zakliucheniia o spektre i magnitnom pole.** [The radiation flux from the Crab Nebula at $\lambda 2\mu$ and some conclusions on the spectrum and magnetic field.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(2):265–274, March/April **1960.** 4 figs., table, 29 refs. Russian and English summaries p. 265. Transl. into English in *Soviet Astronomy AJ*, New York, 4(2):250–251, **1960.** **DLC**—The intensity of radiation from the central region of the Crab Nebula was measured by a stellar electrophotometer with a lead-sulfide photoconductive cell. The monochromatic flux of radiation, normalized to that for the nebula as a whole, is $I_\nu = 1.3 \cdot 10^{-25} wm^{-2}\ (cps)^{-1}$ at 2.2μ. The spectrum of the nebula in the region $0.4–2.2\mu$ is discussed on the basis of present-day data. A conclusion is made that observations in the radio, and also the optical region agree best with the spectrum exponent $\alpha = \text{const} = 0.35$. A spectrum with $\alpha = \text{const}$ shows that energy losses for optical electrons are very low. From here we find $H_\perp \approx 10^{-4}$ gauss, $\gamma = 1.7$, and the total kinetic-energy density of relativistic electrons to be 10^{-7} ergs/cm^3. The total mass of the nebula is estimated as about 1 $M_\odot$, which is an order of magnitude higher than the mass of the filamentary envelope. It is possible that the relativistic electrons in the nebula are not accelerated at present. The energy of relativistic protons probably does not appreciably exceed the energy of the electrons. *Subject Headings:* **1. Nebular radio sources 2. Crab Nebula.**—*Author's abstract.* Ⓢ

11L–354 523.852.22:523.83

Pskovskiĭ, Iu. P. (*P. K. Shternberg State Astron. Inst.*), **A comparison of the distance scales for planetary nebulae with the help of the galactic rotation effect.** *Soviet Astronomy AJ*, New York, 3(2):301–305, March/April **1959.** 3 figs., 4 tables, 13 refs. **DLC.** Transl. of **Sopostavlenie shkal rasstoianiĭ do planetarnykh tumannosteĭ pomoshch'iu effekta galakticheskogo vrashcheniia**, *Astronomicheskiĭ Zhurnal*, Moscow, 36(2):305–310, March/April **1959.** **DLC**—The components of solar velocity and the K-term were found from the radial velocities of 40 planetary nebulae ($r > 2$ kpc). The radial velocities of 81 planetary nebulae were used to derive the Camm function and the A parameter for the distance scales proposed by VORONTSOV-VELIAMINOV and SHKLOVSKIĬ. The parameter A was calculated from Oort's formula by the method of least squares, two groups of 27 nebulae ($r_V > r_S$) and 20 nebulae ($r_V > r_S$) being formed. For distances according to the old scale the values of A for the groups were found to be in disagreement. For distances according to the new scale the values of A were found to be practically the same and this is indirect evidence for its correctness. The distance scale proposed by SHKLOVSKIĬ was compared in a similar manner with the distance scale proposed by BERMAN. The values of A for two groups of 26 nebulae ($r_B < 2r_S$) and 26 nebulae ($r_B < 2r_S$) were again found to disagree only in the case of the scale proposed by BERMAN. In order to derive the usual value for A, i.e., $A = 19.5$ km/sec per kpc, it is necessary to shorten SHKLOVSKIĬ's scale by a factor of 1.5. *Subject Headings:* **1. Planetary nebulae 2. Galactic rotation.**—*Author's abstract.* Ⓢ

11L–355 523.852.22

Razmadze, N. A., **Sverkhplotnaia planetarnaia tumannost'.** [A superdense planetary nebula.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(2):342–344, March/April **1960.** fig., table, 7 refs. Russian and English summaries p. 342. Transl. into English in *Soviet Astronomy AJ*, New York, 4(2): 322–323, **1960.** **DLC**—The relative emission line intensities were determined for the planetary nebula No. 8, according to VORONTSOV-VELIAMINOV's **Catalogue of planetary nebulae.** The intensity of $\lambda 4363$ [OIII] is exceptionally high, that of N_1 and N_2 lines very low. This can be ex-

plained by the large number of superelastic collisions in the nebula. The $I_{\lambda 4363}/IN_1 + IN_2$ ratio was used for estimating the electron density, which was found to be $2.8 \cdot 10$ and 10^6 electrons/cm^3 for $T = 10{,}000°$ and $30{,}000°$ respectively. Thus the investigated object is a superdense planetary nebula. *Subject Heading:* **1. Planetary nebula.**—*Author's abstract.* Ⓢ

11L–356 523.852.24:523.877

Gurzadian, G. A., **Sinkhrotronnoe izluchenie v kometarnykh tumannostiakh.** [Synchrotronic radiation in cometary nebulae.] *Akademiia Nauk SSSR, Doklady*, 130(1):47–50, **1960.** 8 refs., 6 eqs. **DWB, DLC**—The hypothesis that the luminescence of cometary nebulae is produced by the decelerated radiation of relativistic electrons in magnetic fields of nebulae (synchronous radiation) is applied to an explanation of the irregular variation in the brightness and structure of comet nebulae. The picture of variability in brightness and structure is strengthened if the effect of rotation of the stars and the effect of possible fluctuations of potential of the magnetic field are taken into account. Using the specific instance of the cone-shaped protrusion of the comet nebulae characteristic of NGC 2261, the author calculates the concentration of relativistic electrons, the potential of the magnetic field in the central parts of the nebula, the concentrations of neutral H atoms, the ionization of H in the nebula when the ionization is the result of synchrotronic short wave radiations, etc. In NGC 2261 the preponderant portion of H atoms is in the neutral state and the degree of ionization is very low. Under these conditions the optical thickness of the nebulae in the frequencies of L-radiation is $\sim 10^3$ and in the frequencies of lines of the Balmer series of H it is of the order F unity. The synchrotronic radiation is polarized since the plane of polarization must be perpendicular to the magnetic line of force at a given point. In so far as the magnetic lines of force of a unipolar field in the region of the cone of a comet nebula are approximately straight rays their continuous radiation should be in the first approximation prolonged radially in relation to the nucleus and the degree of polarization should be sufficiently high. *Subject Heading:* **1. Nebulae.**—*I.L.D.* Ⓢ

11L–357 523.852.3:535.853

Courtès, Georges and Cruvellier, Paul (*both, Observatoire de Marseille*), **Recherche de l'émission monochromatique dans les régions de forte concentration stellaire.** [Research of the monochromatic emission in high stellar density regions.] *Annales d'Astrophysique*, Paris, 23(3):416–418, May/June **1960.** 2 figs., 6 refs. French, English and Russian summaries p. 416. **DWB, DLC**—Description of a monochromatic radiation selector which gives a contrast 75 times greater than the combination of a filter and a photographic plate. Faint emission regions in high stellar density regions can be detected. It is possible to use a Jacquinot-Dufour spectrometer to measure the radial velocity of the emission nuclei of extragalactic nebulae. *Subject Headings:* **1. Extragalactic nebulae 2. Radial velocity 3. Spectrometers.**—*Authors' abstract.* Ⓢ

11L–358 523.852.3

Heckmann, O. (*Hamburg-Bergedorf*), **The aberration of extragalactic nebulae.** *Annales d'Astrophysique*, Paris, 23(3):410–415, May/June **1960.** 3 tables, 11 refs. French, English and Russian summaries p. 410. **DWB, DLC.**—Measurements of differential annual aberration between stars and nebulae with large radial velocities give negative results. The velocity of light is therefore independent of the velocity of the source. The author also gives the theory of dilatation due to aberration of the images of a nebula in recession. *Subject Headings:* **1. Velocity of light 2. Stellar motion 3. Extragalactic nebulae.**—*Author's abstract.* Ⓢ

11L–359 523.852.31:523.161

†Osterbrock, Donald E. (*Washburn Obs., U. Wisc.*), **Interstellar matter in elliptical galaxies, Pt. 2.** *Astrophysical Journal*, Chicago, 132(2):325–340, Sept. **1960.** 5 figs., 5 tables, 46 refs. **DWB, DLC**—Observations are presented of the emission lines resulting from ionized interstellar gas in elliptical galaxies, together with a preliminary account of their interpretation. The strongest line (with respect to the continuous spectrum) is the (OII) λ3727 line, which occurs in different strengths in different galaxies, down to vanishingly weak intensity. The profile of this line in NGC 4486, the radio source Virgo A, is broad and double. In NGC 4278, an otherwise typical elliptical galaxy with strong interstellar emission line, estimates of the mass, rotational velocity, and turbulent velocity of the ionized gas are given, as well as relative abundances of the observable ions. The mechanism by which the energy that is radiated in the emission lines is replaced is not known, but it may be either from ultraviolet stellar radiation or from the conversion of stellar kinetic energy ultimately into heat. It is probable that all elliptical galaxies contain interstellar gas and that the observed relative strength or absence of emission lines is largely an effect of ionization. The similarities and differences between the gas cloud in the nucleus of the elliptical galaxy NGC 4278 and the gas clouds in the nuclei of our Galaxy, of M31, and of M81 are briefly discussed. *Subject Headings:* **1. Galactic emissions 2. Interstellar matter.**—*Author's abstract.* Ⓢ

GALAXIES

See also: **Star formation and galactic magnetic field** (Mestel), 11L–8; **Galactic thermal radio emission** (Pronik), 11L–80; **Distribution of relativistic electrons in the galaxy** (Syrovatskiĭ), 11L–106; **Radio resolution of galactic nucleus** (Drake), 11L–108; **Radio emission by spiral arms** (Field), 11L–109; **Radio continuum from the galaxy** (Mills), 11L–110; **21 cm radiation from galactic neutral hydrogen** (Radhakrishnan), 11L–114; **Observation of galaxies and cosmological models** (Couderc), 11L–319; **Blue galaxies** Rostovskaia), 11L–348; **Interstellar matter in elliptical galaxies** (Osterbrock), 11L–359.

11L–360 523.854:523.162

†Dufay, Jean (*Observatoires de Lyon et de Haute-Provence*). **La condensation centrale de la galaxie.** [The central condensation of the Galaxy.] *Annales d'Astrophysique*, Paris, 23(3):451–464, May/June **1960.** 2 figs., table, 30 refs., 2 plates. French, English and Russian summaries. **DWB, DLC**—The absorption in front of the great stellar cloud discovered by infrared photography around the direction of the center of the Milky Way is evaluated by three different methods. The observation of a new globular cluster which is practically invisible in blue light and which apparently lies in the cloud, leads to the hypothesis that this cloud belongs to the central condensation around the center of the Galaxy, and not to a spiral arm between the sun and the center. Color excesses of blue giants, measured by HILTNER in this direction, give a partial localization of absorbing clouds which are, in general, very close. The dimensions of the central condensation, including the great cloud of Sagittarius and the infra-red cloud are estimated roughly. They are comparable with the dimensions of the central condensation of the galaxy N.G.C. 4565 (Sb type). *Subject Headings:* **1. Interstellar absorption 2. Infrared photography 3. Galactic structure.**—*Author's abstract.* Ⓢ

11L–361 523.854.1

Idlis, G. M. (*Acad. Sci., Kazakh S.S.R.*), **Dynamics of the Magellanic Clouds and their origin from the galaxy as a probable result of a collision of the galaxy with NGC 55.** *Soviet Astronomy AJ*, New York, 3(4):680–697, Jan. Feb. **1960.** fig., table, 28 refs., 122 eqs. **DLC.** Transl. of **Dinamika Magellanovykh oblakov i ikh proiskhozhdenie iz Galaktiki kak veroiatnyĭ rezul'tat ee stolkoveniia s vnegalakticheskoĭ tumannost'iu NGC 55,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(4):700–718, July/Aug. **1959. DLC**—From the distribution of relative radial velocities, interpreted as the result of axial rotation, the effective dimensions and total masses of the Large and Small Magellanic Clouds are determined. On the basis of the mean radial velocities of the gravitationally interconnected Magellanic Clouds, which rotate with respect to one another, their probable common tangential motion is estimated, the galactocentric space velocity of the orbital motion of their center of mass found, and the corresponding elliptical galactic orbit determined. The hypothesis of the origin of the Magellanic Clouds from the Galaxy as the result of its collision with some other galaxy is analyzed and it is found that the expected present characteristics of such a galaxy coincide with the corresponding observational data for NGC 55. It is predicted that the radial velocities in NGC 55 should increase from west to east (reverse axial rotation by comparison with the direct hyperbolic orbital motion relative to our galaxy). *Subject Heading:* **1. Magellanic clouds.**—*Author's abstract.* Ⓢ

11L–362 523.854.12

Münch, Guido (*Mount Wilson and Palomar Observatories*), **On the interpretation of the spiral structure in the galactic system.** *Annales d'Astrophysique*, Paris, 23(3):403–409, May/June **1960.** 3 figs., 4 refs. French, English and Russian summaries p. 403. **DWB, DLC**—The interpretation of galactic structure by means of the 21 cm hydrogen line is connected with the hypothesis of a circular motion of the interstellar gas. Some systematic relative motions between remote O and B stars and gas have been found through measurements of radial velocities and interstellar absorption lines. Electronic photography should help to extend such studies. *Subject Headings:* **1. Galactic structure 2. Interstellar absorption 3. Electronic photography.**—*Author's abstract.* Ⓢ

11L–363 523.854.12

Uranova, T. A. (*P. K. Shternberg State Astron. Inst.*), **Absorption of light in a region in the rift of the Milky Way.** *Soviet Astronomy AJ*, New York, 3(4):718–720, Jan./Feb. **1960.** 2 figs., 8 refs. **DLC.** Transl. of **Pogloshchenie sveta v oblasti razvetvleniia mlechnogo puti,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(4):740–743, July/Aug. **1959. DLC**—Preliminary results are given of a determination of the absorption of light in a region in the rift of the Milky Way (Aquila constellation). The results were obtained from a study of the photoelectric colors and the density of the apparent distribution and stars with known distance moduli. A schematic representation of the structure of the dark nebula which occupies the investigation region of the sky is given. *Subject Headings:* **1. Light absorption 2. Milky Way.**—*Author's abstract.* Ⓢ

11L–364 523.854.22

Struve, Otto (*Leuschner Obs., Univ. of Calif.*), **Spiral structure of the Milky Way.** *Sky and Telescope*, N. Y., 18(7):364–369, May **1959.** figs., photos. **DWB, DLC**—An explanation of various theories relating to the spiral structure of the Milky Way with illustrations of theories of J. H. Oort, F. J. Kerr, F. Westerhaut, and B. J. Bok. Sketches show the rigid body rotation system and the Keplerian rotation system. A copy of a drawing by J. H. Oort and G. W. Rougoor shows the center disk of the galaxy in position relative to the Sun. *Subject Headings:* **1. Milky Way 2. Galactic structure.**—*E.Z.S.* Ⓢ

11L–365 523.854.22

Vorontsov-Velıaminov, B. A., **Kol'tsevye, galaktiki.** [Ring galaxies.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(3):381–386, May/June **1960.** 2 figs., 4 refs. Russian and English summaries p. 381. Transl. into English in *Soviet Astronomy AJ*, New York, 4(3):365–371, Nov./Dec. **1960. DLC**—Representatives of galaxies with ring forms, hundreds of which were found on the charts of the Palomar Sky Atlas, are described. These objects do not belong the ordinary SB type galaxies with a bar, rind and spiral arms emanating from this ring. It is shown that there exist pure ring galaxies without a bar and without spiral arms. A continuous transition from such galaxies to galaxies SO, SB, spirals with one arm and to galaxies with spiral arms winding in opposite directions and originating from one place, is traced. Similar to the spirals, the ring galaxies are of subtype a, b, and c. In view of the above the ring forms should be considered as elements of structure along with bars, spiral arms and disks. As a preliminary designation for galaxies, which have a ring as their main structural element, the symbol SR is proposed temporarily. *Subject Heading:* **1. Galactic structures.**—*Author's abstract.* Ⓢ

11L–366 523.854.23

Idlis, G. M. (*Acad. Sci., Kazakh S.S.R.*), **The symmetry of stationary axially symmetric stellar systems relative to the equatorial plane.** *Soviet Astronomy AJ*, New York, 3(1):88–91, Jan./Feb. **1959.** 2 refs., 28 eqs. **DLC.** Transl. of **Simmetriia statsionarnykh osesimmetrichnykh zvezdnykh sistem otnositel'no ekvatorial'noĭ ploskosti,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(1):85–88, Jan./Feb. **1959. DLC**—It is proved theoretically that stationary axially symmetric self-gravitating stellar systems with finite mass are symmetrical relative to the equatorial plane. *Subject Headings:* **1. Stellar systems 2. Galactic structure.**—*Author's abstract.* Ⓢ

11L–367 523.854.3:521.114

Agekian, T. A. (*Astron. Obs., Leningrad State Univ.*), **The probability of a stellar approach with a given change of the absolute velocity.** *Soviet Astronomy AJ*, New York, 3(1):46–58, Jan./Feb. **1959.** 4 refs., 78 eqs. **DLC.** Transl. of **Veroiatnost' zvezdnogo sblizheniia s zadannym izmeneniem absoliutnoĭ skorosti,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(1):41–53, Jan./Feb. **1959. DLC**—A method which allows concrete problems dealing with the effect of an irregular field in stellar systems to be reduced to the problem of random Markov processes is proposed. For this purpose, the probability is found that in time dt there will be an encounter between a given star and a star of the field such that the square of the velocity of the star will change by an amount Δ lying between ΔV^2 and $\Delta V^2+d\Delta V^2$. The parameters characterizing the field of the stellar system and the star under consideration must be known. An expression for the probability has been derived for the general case when the mass-distribution function is arbitrary. Two important particular cases are considered: 1) all the stars of the field and the star under consideration are of equal mass; 2) the stars of the field are of equal mass, the mass of the star under consideration is zero. For these cases the expression for the probability is considerably simplified. *Subject Heading* **1. Stellar systems.**—*Author's abstract.* Ⓢ

11L–368 523.854.3

Parenago, P. P. (*P. K. Shternberg State Astron. Inst.*), **On the observational difference between the expressions for the galactic potential according to Kuzmin and to Parenago.** *Soviet Astronomy AJ*, New York, 3(1):180–182, Jan./Feb. **1959.** 2 figs., 4 refs., 6 eqs. **DLC.** Transl. of **O nabliudatel'nom razlichii vyrazheniĭ galakticheskogo potentsiala po Kuzminu i po Parenago,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(1):179–181, Jan./Feb. **1959. DLC**—It is shown that the expressions for the galactic potential in the galactic plane deduced by Kuzmin in 1954 and by Parenago in 1952 lead to values of circular velocities of different distances from the galactic center which are very close to each other, and that it is impossible to establish from existing determinations of nearly circular velocities which of these two expressions represents reality more closely. This will only become possible in the future when more accurate determinations of velocities and distances become available. *Subject Headings:* **1. Galactic rotation 2. Stellar motion.**—*Author's abstract.* Ⓢ

11L–369 521.114:523.164.42:523.838:523.854.3

Pskovskiĭ, Iu. P. (*P. K. Shternberg State Astron. Inst.*), **An investigation of the parameters of galactic rotation based on radial velocities of Cepheids and radio observations of the emission lines of interstellar hydrogen.** *Soviet Astronomy AJ*, New York, 3(3):439–446, Dec. **1959.** 4 figs., 2 tables, 18 refs., 13 eqs. **DLC.** Transl. of **Issledovanie parametrov galakticheskogo vrashcheniia po luchevym skorostiiam Tsefeid i po radionabliudeniiam emissionnoĭ linii mezhzvezdnogo vodoroda,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(3):448 456, May/June **1959. DLC**—The Camm function was found in two variants: $R_0 = 8.2$ kpc, from the radial velocities of 164 Cepheids studied. The value of A in the Sun's vicinity was obtained as 20 km/sec per kiloparsec in both variants. The distances to the Cepheids were computed with a correction of -0^m7 to KUKARKIN'S zero-point, and the dependence of γ on CE taken into account. It is shown that the Camm function computed on the basis of the theory of rotation of a stationary Galaxy is in good agreement with that computed on the basis of velocities of Cepheids, and that, based on observations of the radio frequency emission line of interstellar hydrogen ($\lambda = 21$ cm) at $R_0 = 7.2$ kpc. An attempt was made to determine the first- and second-order parameters in the expansion of the formula for galactic rotation. A comparison of observational data with an estimate obtained on the basis of the theory of rotation of a stationary Galaxy points to large systematic errors in the evaluation of the parameters of galactic rotation when using remote Cepheids. *Subject Headings:* **1. Interstellar hydrogen 2. Galactic rotation 3. Cepheids.**—*Author's abstract.* Ⓢ

11L–370 523.854.3 523.859

Vorontsov- Veliaminov, B. A. (*P. K. Shternberg State Astron. Inst.*), **Interaction of galaxies.** *Annales d'Astrophysique*, Paris, 23(3):379 384, May/June **1960.** plate. **DWB, DLC**—The author gives his reasons for doubting that the filaments of matter ejected from galaxies might have a gravitational origin. He thinks that there are unknown microscopic properties in the galaxies that produce such phenomena. The author presents and describes an atlas of interacting extragalactic objects. *Subject Heading:* **1. Galactic structure 2. Galactic interaction.**—*Author's abstract.* Ⓢ

11L–371 523.12:523.854/5

Agekian, T. A., **Obshchie cherty evoliutsii vrashchaiushchikhsia sistem gravitiruiushchikh tel.** [General features of the evolution of rotating systems of gravitating bodies.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(2):317 326, March/April **1960.** 2 tables, 26 refs., 17 eqs. Russian and English summaries p. 317. Transl. into English in *Soviet Astronomy AJ*, New York, 4(2):298–307, **1960. DLC**—The evolution of rotating systems of gravitating bodies is studied qualitatively. The stage of development of the galaxy is determined from the character of the distribution of residual stellar velocities. Some remarks on the properties of galactic nuclei are presented. *Subject Headings:* **1. Cosmogony 2. Galactic evolution.**—*Author's abstract.* Ⓢ

11L–372 523.854/5

Minkowski, R. (*Mount Wilson and Palomar Observatories*), **Problems of extragalactic spectroscopy.** *Annales d'Astrophysique*, Paris, 23(3):385–396, May/June **1960.** fig., 2 tables, 12 refs., plate. French, English and Russian summaries p. 385. **DWB, DLC**—The author gives the characteristics of the most powerful spectrographs and their results in determining radial velocities, relative motions in clusters of galaxies, the rotation of galaxies or the correlation between spectral features and absolute magnitudes of galaxies. The gain in speed offered by photoelectric devices should lead to rapid progress in these fields. *Subject Headings:* **1. Extragalactic spectroscopy 2. Stellar velocities 3. Radial velocities 4. Galactic clusters 5. Galactic rotation.**—*Author's abstract.* Ⓢ

11L–373 523.855

de Vaucouleurs, Gerard (*Harvard College Obs.*), **The local supercluster of galaxies.** *Soviet Astronomy AJ*, New York, 3(6):897 912, May/June **1960.** This is original English of which a translation appeared in *Astronomicheskiĭ Zhurnal*, Moscow, 36(6):977 996, Nov./Dec. **1959. DLC**—The historical background for the notion of superclustering or clustering of the second order of galaxies is briefly reviewed. The evidence for superclustering among the brighter galaxies is then discussed in some detail, including the initial indications of large-scale rotation in the universe. The new studies of the Local Supercluster beginning in 1951–52 are described; maps of the galactic and supergalactic distribution of bright galaxies are given; the north pole of the Supergalaxy is at $l = 15°$, $b = +5°$; the nucleus is in the Virgo cluster. The concentration of galaxies of different magnitudes to the supergalactic plane is determined; the over-all diameter of the supersystem is about 30 Mpc, if the distance R_1 of the nucleus is 10 Mpc. The new evidence for differential rotation and expansion of the Local Supercluster is summarized and illustrated; a simple model is described, which accounts quantitatively for the nonlinearity and nonisotropy of the velocity field among galaxies brighter than the 14th magnitude. The rotational component of the velocity of the Galaxy

is about 500 km per sec toward $L = 194°$ ($l = 187°$, $b = -14°$); the mass of the supercluster is about 10^{15} solar masses, the period of revolution varies from $5 \cdot 10^8$ years near the center, and from 100 to 200 billion years in the outer regions. An application to the calibration of the Hubble expansion parameter outside the Local Supercluster gives $H = 174$ km/sec per Mpc if $R_1 = 10$ Mpc (140 if $R_1 = 12.6$ Mpc). The conflicting evidence on radio emission from the Local Supercluster is reviewed in an appendix. *Subject Heading:* **1. Galactic superclusters.**—*Author's abstract.* Ⓢ

11L–374 523.855:523.875/7

Liller, Martha Hazen (*Univ. Michigan Obs.*), **The distribution of intensity in elliptical galaxies of the Virgo Cluster.** *Astrophysical Journal*, Chicago, 132(2):306–324, Sept. **1960.** 7 figs., 7 tables, 17 refs., 5 eqs. **DWB, DLC**—The distribution of absolute surface intensity has been measured for fifteen elliptical galaxies and nine spiral and barred spiral galaxies in the Virgo Cluster. The observations included blue plates taken with the 24–36 inch Curtis Schmidt telescope of the University of Michigan and with the 48-inch Schmidt telescope of the Mount Palomar Observatory. Isophotes were drawn for the galaxies with the University of Michigan isophotometer. For each galaxy, the surface brightness, ellipticity, and position angle have been tabulated as a function of the major axis of the corresponding isophote. Integrated magnitudes for several of the galaxies have been determined. From two independent arguments it has been concluded that the largest elliptical galaxies in the Virgo Cluster are of globular form; the lenticular, or highly oblate spheroidal, galaxies are to be found among somewhat smaller and fainter systems. Three-dimensional luminosity distributions for the globular galaxies and also for the lenticular galaxies have been derived from the observed intensity and ellipticity data. *Subject Headings:* **1. Galactic emissions 2. Galactic clusters.**—*Author's abstract.* Ⓢ

SPECTRA OF STARS AND NEBULAE

See also: **San Francisco meeting, 1959** (Astron. Soc. Pacific), 11L–1; **Stellar astronomy from space vehicle** (Code), 11L–28; **Spectroscopic satellite** (Spitzer, Zabriskie), 11L–31; **Absolute spectrophotometric gradients for stars** (Mel'nikov et al.), 11L–50; **Radio spectral lines,** 11L–115 to 11L–118; **Spectrophotometric determination of types, brightnesses and ages of stars** (Chalonge), 11L–320; **Spectrum of RR Telescopii** (Pottasch, Varsavsky), 11L–331; **Energy distribution in spectrum on RR Lyrae** (Oke, Bonsack), 11L–334; **Spectrum-luminosity diagram for pleiades** (Kotok), 11L–344; **Lines of heavy elements in spectra of planetary nebulae** (Nikitin), 11L352.

11L–375 523 535.33

Swings, P. (*Institut d'Astrophysique de Liège, Belgium*), **Quelques réflexions d'un spectroscopiste.** [Some reflections of a spectroscopist.] *Annales d'Astrophysique*, Paris, 23(3):422–430, May/June **1960.** French, English and Russian summaries p. 422. **DWB, DLC**—Individual spectroscopic studies are of great importance. Spectroscopic observations in the infrared and far ultraviolet should be prepared and our knowledge of spectroscopic properties in classical fields should also be improved in order to find solutions to the following problems: interstellar matter, planetary nebulae, symbiotic stars, W, Of and Be stars, relative abundances in stars of population type II, isotopic abundances in stars and planets, variable stars, etc. *Subject Headings:* **1. Astrophysics 2. Spectroscopy.**—*Author's abstract.* Ⓢ

11L–376 523.87

Pikel'ner, S. B.; Shklovskiĭ, I. S. and Ivanov-Kholodnyĭ, G. S., **On possible mechanisms of emission of discrete galactic objects in the spectral region 1225–1350 A.** *Soviet Astronomy AJ*, New York, 3(2):263–266, March/April **1959.** 9 refs. **DLC.** Transl. of **O vozmozhnykh mekhanizmakh izlucheniia diskretnykh galakticheskikh ob"ektov v oblasti 1225–1350 Å,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(2):264–268, March/April **1959. DLC**—The possibility of explaining the emission of discrete galactic sources observed in the spectral region 1225–1350 A, by usual mechanisms is examined. However, this explanation makes necessary the assumption that the absolute values of brightness of galactic sources in this spectral region were considerably overestimated. Separate sources (for example α Vir) are identified with H II regions in the neighborhood of hot stars; up to now they have not been observed in Hα because of their low luminosity. *Subject Heading:* **1. Galactic emissions.**—*Authors' abstract.* Ⓢ

11L–377 523.87

Dolidze, M. V. and Arakelian, M. A. (*both, Acad. Sci., Georgian S.S.R. and Armenian S.S.R.*), **The T-association near ρ Ophiuchi.** *Soviet Astronomy AJ*, New York, 3(3):434–438, Dec. **1959.** fig., 3 tables, 4 refs. **DLC.** Transl. of **T-assotsiatsiia okolo ρ Zmeenostsa,** *Astronomicheskiĭ Zhurnal*,

Moscow, 36(3):444–447, May/June **1959. DLC**—Eighty-eight *Hα* bright-line stars were detected around the dark nebulosity connected with ρ Ophiuchi, using an objective prism attached to the 70-cm meniscus telescope, and a combination of red filter and Kodak OaE emulsion. *Subject Headings:* **1. Nebulae 2. Stellar spectroscopy 3. Bright-line stars.**—*Authors' abstract.* Ⓢ

11L–378 523.87:535.34

Sobolev, V. V. (*Leningrad State Univ.*), **Some remarks on the spectra of Be type stars.** *Soviet Astronomy AJ*, New York, 3(5):735–743, March/April **1960.** fig., table, 13 refs., 35 eqs. Transl. of **Nekotorye zamechaniia o spektrakh zvezd tipa Be,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(5):753–761, Sept. Oct. **1959. DLC**—The problem of emission-line profiles and intensities in the spectra of Be type stars is considered. The concentration of hydrogen atoms in the envelopes is determined. Papers by MENZEL and BAKER and G. R. and E. M. BURBRIDGE are discussed. *Subject Heading:* **1. Stellar spectra.**—*Author's abstract.* Ⓢ

11L–379 523.872

Kupo, I. D. (*Astrobotanical Div., Acad. of Sci., Kazakh S.S.R.*), **Spectrophotometric study of χ Ophiuchi, Pt. 2, Some properties of the emission spectrum of χ oph.** *Soviet Astronomy AJ*, New York, 4(1):85–90, July/Aug. **1960.** 6 figs., 2 tables, 11 refs. **DLC.** Transl. of **Spektrofotometricheskoe issledovanie χ Zmeenostsa, II. Nekotorye osobennosti emissionnogo spektra χ Zmeenostsa,** *Astronomicheskiĭ Zhurnal*, Moscow, 37(1):88–94, Jan./Feb. **1960. DLC**—The equivalent widths of hydrogen emission lines have been found from 126 spectrograms. The intensity of the emission lines measured relative to the continuous-spectrum intensity level varies strongly. The intensity of the emission above the mean level of the absorption components $E-A$, tends to a constant for the H_δ and H_ϵ lines, and to two discrete values for H_γ. Changes in the photographic magnitude of the star lead to different degrees of "merging" of the lines into the continuous spectrum. A dependence is noted between the intensity of emission with $\lambda < 4400$ A, and the equivalent width of the H_β emission line. A statistical check showed that the increase in the intensity of the lines is accompanied by a reduction in their half-width. The Balmer decrements in the χ Oph spectrum have been determined. The mean value of the decrements is close to the theoretical value found by SOBOLEV (3). The P Cyg structure was often observed in the H_γ line, and, in several cases, the second emission component was also shifted toward shorter wavelengths. A rough estimate has been made of the heights of the emission zone of χ Oph and is in satisfactory agreement with that obtained by other authors. *Subject Headings:* **1. Stellar spectra 2. Hydrogen emission.**—*Author's abstract.* Ⓢ

11L–380 523.872:523.841.3

Mel'nikov, O. A. (*Acad. Sci., U.S.S.R.*), **The intensity of quadrupole multiplet lines of ionized iron.** *Soviet Astronomy AJ*, New York, 3(3):381–388, Dec. **1959.** 6 figs., 5 tables, 22 refs., eq. **DLC.** Transl. of **Ob intensivnostiiakh liniĭ kvadrupol'nykh mul'tipletov ionizirovannogo zheleza,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(3):385–393, May/June **1959. DLC**—Visual estimates of the Fe II emission line intensities in the spectra of two variable stars, η Carinae and XX Ophiuchi, have been calibrated. As a result, the relative line intensities of (Fe II) quadrupole multiplets: $3d^64s a^6D - 3d^5 \cdot 4s^2 a^6S$ and $3d^74F - 3d^64s^4G$ were found. It is shown that these intensities, reduced to line strengths (according to E. CONDON and G. SHORTLEY), are apparently in agreement with the quantum-mechanical intensities and satisfy the sum rule. The excitation temperature in the atmosphere of XX Ophiuchi was estimated to be $T \approx 10{,}000°K$ by means of a calibration of Ti II lines against the line intensities of laboratory spark spectra and theoretical strengths for LS-coupling. At present, more accurate spectrophotometric data on the (Fe II) quadrupole multiplets apparently do not exist. *Subject Heading:* **1. Stellar spectra.**—*Author's abstract.*

11L–381 523.873

Davis, Sumner P. (*Dept. Physics, Univ. Calif., Berkeley*), **Hyperfine structure, Zeeman effects, and separation of lines in terbium spectra.** *Astrophysical Journal*, Chicago, 132(2):486–492, Sept. **1960.** 2 tables, 14 refs. **DWB, DLC**—Hyperfine structure splittings have been measured for 232 lines in terbium spectra, Zeeman effects measured for approximately 600 lines, and relative intensities in arc and spark spectra estimated for approximately 3500 lines. The splittings form a practically continuous range of values within the limits of uncertainties of measurement. The ground states of Tb I and Tb II have not been found; nearly 90 per cent of the Zeeman patterns are unresolved. The relative intensity estimates may prove helpful for analysis. *Subject Headings:* **1. Stellar spectra 2. Terbium spectra.**—*Author's abstract.* Ⓢ

11L–382 523.874

Fitch, W. S. (*Steward, Obs., Univ. Arizona*), **Rediscussion of Delta Scuti.** *Astrophysical Journal*, Chicago, 132(2):430–434, Sept. **1960.** 3 tables, 14 refs., 2 eqs. **DWB, DLC**—FATH's photometric

measures of δ Scuti have been analyzed by performing least-squares fits of his observations to sine-term expansions in various periods. The results of the analysis show that the following incommensurable, but related, periods are excited in this star: the fundamental $P_0 = 0.193770$ day, the second overtone $P_0 = 0.095129$ day, and the resonance term $P_R = 0.186872$ day. A similar treatment of the radial-velocity observations reported by PADDOCK and STRUVE generally confirms the results obtained in the discussion of the light-variation. Maximum light precedes maximum expansion velocity by about 0.07 period for the three terms P_0, P_R, and P_0 individually. The light- and velocity variations are approximately represented by two equations. *Subject Headings:* **1. Stellar spectra 2. Delta Scuti.**—*Author's abstract.* Ⓢ

11L–383 523.813:523.875

Artiukhina, N. M. (*P. K. Shternberg State Astron. Inst.*), **Absolute proper motions of 21 variables of the RW Aur type.** *Soviet Astronomy AJ*, New York, 3(5):808–812, March/April **1960.** 4 tables, 6 refs. **DLC.** Transl. of **Absoliutnye sobsvennye dvizheniia 21 peremennoĭ zvezdy tipa RW Voznichego,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(5):832–837, Sept./Oct. **1959. DLC**—The absolute proper motions of 21 RW Aur type stars were determined using meridian and photographic positions. The mean parallax $\pi_0 = 0''.0035$ was found from the parallactic components of the proper motions of 17 stars, whose identification as RW Aur type stars is most certain. The mean distances of the group of stars considered (300–400 parsecs) is in good agreement with the distance to these stars determined from the spectrum-luminosity diagram. *Subject Headings:* **1. Proper motions of stars 2. Stellar motion.**—*Author's abstract.* Ⓢ

11L–384 523.875

Kholopov, P. N. (*Acad. Sci., U.S.S.R.*), **The system of T-associations.** *Soviet Astronomy AJ*, New York, 3(3):425–433, Dec. **1959.** 8 figs., table, 12 refs. **DLC.** Transl. of **Sistema T-assotsiatsiĭ,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(3):434–443, May/June **1959. DLC**—On the basis of previous data published by the author the apparent and the spatial distribution of T-associations is discussed. The T-associations form a flat system. The existence of chains of T-associations is demonstrated. Counts of variables of different types included in the composition of T-associations, as well as estimates of the total number of such stars in the Galaxy, are given. It is shown that T-associations exist in all of the scattered agglomerations of hot stars found within a range of 500 parsecs from the sun. The fundamental spectra composition of T-associations imbedded in nebulosities is exactly the same, irrespective of the presence or absence of O-BO type stars in them. This provides evidence of the absence of any basic difference between O-associations and T-associations. The partial densities of T-associations not in association with nebulosities are much lower than the densities of associations imbedded in nebulosities, and their diameters are much greater than the diameters of the latter. This may be evidence of a gradual expansion of T-associations, accompanied by the transformation of In-type variables into Is-type stars. Some considerations are given in support of the need to divide up the stars of the flat component into stars belonging to the spiral component and disk stars. The Hertzsprung-Russell diagram for stellar associations (11) may be viewed as the H-R diagram applying to the stars of the spiral component. *Subject Headings:* **1. Stellar associations 2. Stellar spectra.**—*Author's abstract.* Ⓢ

11L–385 523.875

Pagel, B. E. J. (*Royal Greenwich Obs., Herstmonceux, Sussex*), **The excitation of emission lines in the spectra of early-type stars.** (In Beer, Arthur (*ed.*), **Vistas in Astronomy, Vol. 3,** pub. **1960.** p. 203–257. 2 figs., 9 tables, 69 refs., 128 eqs.) **DWB** (520.82 B415v), **DLC** (QB3.B35)—In a plane-parallel atmosphere, in radiative and local thermodynamic equilibrium, emission lines cannot normally arise. The presence of emission lines requires either a combination of thermal re-emission in the line with scattering in the continuum (Schuster-Underhill mechanism); or fluorescence; or scattering in a moving envelope. The various basic mechanisms for the production of emission lines are discussed: Of stars show the effects of selective fluorescence, while in WR, P Cygni and Be stars Zanstra's primary fluorescence mechanism appears to be operative. Rottenberg's effect of the scattering of stellar line radiation gives an elegant explanation of the P Cygni and Be profiles, but needs to be supplemented by a consideration of fluorescence effects before it can be applied to the higher members of a series. The analysis of line intensities in WR and P Cygni stars according to Beal's hypothesis is discussed in some detail, with special reference to the statistical equilibrium of hydrogen and helium in envelopes. Finally the transfer of radiation in envelopes is discussed, with special reference to Sobolev's theory, in which self-absorption in a moving envelope is taken into account in a very elegant manner. It is concluded that Sobolev's theory offers much new insight, but is not universally applicable; for example, the measured ratio of Paschen to Balmer lines in the spectrum of P Cygni suggests that there is little self-absorption present in the higher members of the series. *Subject Heading:* **1. Stellar spectra.**—*Author's abstract.* Ⓢ

11L–386 523.875

Sobolev, V. V., **K teorii razvitiia zvezd.** [Theory of stellar evolution.] *Astronomicheskii Zhurnal*, Moscow, 37(3):387–395, May/June **1960.** 2 refs., 49 eqs. Russian and English summaries p. 387. Transl. into English in *Soviet Astronomy AJ*, New York, 4(3):372–379, Nov./Dec. **1960.** **DLC**—The problem of non-stationary transfer of radiation in a star is considered. The mean time of escape of energy from a star is estimated. Some conclusions on equations, describing the development of stars, are made. *Subject Heading:* **1. Stellar evolution.**—*Author's abstract.* Ⓢ

11L–387 523.875 523.154.7

Varsavsky, Carlos M. (*Harvard Coll. Obs.*), **The gravitational contraction times of stars in very young clusters.** *Astrophysical Journal*, Chicago, 132(2):354–360, Sept. **1960.** 4 figs., 2 tables, 12 refs. **DWB, DLC**—A group of stars, presumably in gravitational contraction, were observed photoelectrically; their spectra were investigated earlier by Joy (1949). The results of combining the two types of observations indicate that, probably because of the influence of emission lines, the B-V color is not a good measure of the effective temperature of the star. For a given effective temperature we observe a range in B-V of up to 0^m8 toward the blue side of the relationship for normal stars. Taking this effect into account, we find no discrepancy between the observed color-magnitude diagrams of very young clusters and those predicted from a theory of gravitational contraction. *Subject Heading:* **1. Stellar contraction.**—*Author's abstract.* Ⓢ

PHYSICAL AND CHEMICAL CONSTITUTION, THERMODYNAMICS OF STARS

See also: **Stellar plasma**, 11L 13 to 11L 18; **Emission of light by shock waves** (Kaplan, Klimishin), 11L 20; **Pulsational theory of stellar variability** (Zhevakin), 11L 329.

11L–388 523.877

Demarque, Pierre (*David Dunlap Obs., U. Toronto*), **The structure of population II stars.** *Astrophysical Journal*, Chicago, 132(2):366–379, Sept. **1960.** 2 figs., 4 tables, 27 refs., 44 eqs. **DWB, DLC**—Interior models for metal-deficient stars are constructed for values of $Z=0.001$, $Z=0.005$, and $Z=0.01$, for masses ranging from 0.6 to 1.0 solar mass, and hydrogen content X varying from 0.75 to 0.99 by weight. The models have a structure similar to that of red dwarf stars, investigated by Osterbrock in 1953. They have a radiative core and a convective envelope in adiabatic equilibrium. The energy production is due to the proton-proton reaction, and Keller and Meyerott's tables (1955) are used for the opacity. In order to know the depth of the convective zone and therefore the position of the star in the Hertzsprung-Russell diagram, the outer boundary conditions as given by the physical conditions in the subphotospheric layers must be determined. In the atmosphere of stars with effective temperatures in the vicinity of the sun's, the temperature gradient does not approach the adiabatic gradient as soon as convection sets in; there is an intermediate zone where one has to take into account the effect of the superadiabatic gradient. Model atmospheres are constructed, making use of the theory of the mixing length as developed by Biermann. Both cores and atmospheres were integrated with the help of the University of Toronto IBM 650 computer. Integrations for adiabatic envelopes have been given by Osterbrock (1953). The resulting models enable us to establish clearly the respective positions of main sequences for stars of various compositions in the theoretical Hertzsprung-Russell diagram. It is found that the shifts in position between main sequences of different chemical contents do not exceed a few tenths of a magnitude, even in cases of extreme metal deficiency. This is in good agreement with recent observational results. The mass-luminosity law, nevertheless, is not unique for stars with different chemical abundances. *Subject Headings:* **1. Stellar structure 2. Stellar atmospheres.**—*Author's abstract.* Ⓢ

11L–389 523.877

Peeker, J. C. (*Observatoire de Paris-Meudon*), **Les déterminations d'abondances et leurs exigences expérimentales.** [The determination of abundances and its experimental requirements.] *Annales d'Astrophysique*, Paris, 23(3):366–372, May/June **1960.** fig., 11 refs., 4 eqs. French, English and Russian summaries p. 366. **DWB, DLC**—The determination of line profiles is essential in research concerning the chemical composition of stars. The author shows in the case of neutral titanium in the sun that the method of equivalent width is insufficient. Even the multiplet procedure is much too imprecise. *Subject Headings:* **1. Chemical composition of stars 2. Electronic photography.**—*Author's abstract.* Ⓢ

11L–390 523.877:523.841.37

Kurochkin, N. E. (*P. K. Shternberg State Astron. Inst.*), **Luminosity-variation amplitudes and the applicability of a black-body model to the study of cepheids.** *Soviet Astronomy AJ*, New York, 4(1):97–105, July/Aug. **1960.** 10 figs., 24 refs., 18 eqs. **DLC.** Transl. of **Amplitudy kolebaniia**

bleska i primenimost' modeli chernogo tela k izlucheniiu Tsefeid, *Astronomicheskiĭ Zhurnal*, Moscow, 37(1):101–110, Jan./Feb. **1960. DLC**—The dependence of light-variation amplitudes of cepheids on temperature variation is considered. The observed linear relations (Δm, $\Delta T/T$), (Δm, $\Delta 1'$) are explained on the basis of a black-body model of stellar radiation. This provides a means of determining the absolute magnitudes if there are sufficiently precise parallel observations of brightness, color or spectrum, and radial velocities. If it is assumed that the pulsations of the lower layers are mechanically transferred to the upper layers, and are reflected from some upper boundary so that a stationary wave ensues, then, from the time-lag of the light curve relative to the radial-velocity curve, it is possible to estimate the height of the chromosphere above the photosphere, and derive a more precise value of the absolute magnitude. *Subject Headings:* **1. Stellar radiation 2. Cepheids.** —*Author's abstract.* Ⓢ

11L–391 523.877

Shklovskiĭ, I. S. (*Acad. Sci., U.S.S.R.*), **Corpuscular emission from early-type stars as a possible cause of emission from nebulae in the region 1225 1350 Å.** *Soviet Astronomy AJ*, New York, 3(4):569–574, Jan./Feb. **1960.** 12 refs., 11 eqs. **DLC.** Transl. of **Korpuskuliarnoe izluchenie zvezd rannykh spektral'nykh tipov kak vozmozhnaia prichina izlucheniia tumannosteĭ v oblasti 1225 1350 Å,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(4):579–584, July/Aug. **1959. DLC**—Elementary processes taking place during the passage of corpuscles ejected by a hot star through a gas nebula are considered. Charge-exchange reactions in the ground and excited states and also excitation and ionization due to collisions will be most significant. As a result of such processes the corpuscles will lose energy, mainly in the form of L_α quanta with large frequency shifts. This explains the ultraviolet emission from nebulae detected by means of rockets. The scattering of L_α quanta in the nebula by fast corpuscles, some of which have become partly neutral, is an additional source of emission. Thus, the source of ultraviolet emission from gas nebulae may be the intense stellar corpuscular emission, the energy of which is comparable to, or even sometimes greater than, that of the photon emission from these stars. *Subject Headings:* **1. Corpuscular emissions from stars 2. Stellar emissions 3. Ultraviolet emissions from nebulae.**—*Author's abstract.* Ⓢ

11L–392 534:523.877

Kaplan, S. A. and Klimishin, I. A. (*both, L'vov Astron. Observ.*), **Shock waves in stellar envelopes.** *Soviet Astronomy AJ*, New York, 3(3):404–414, Dec. **1959.** fig., 15 refs. 5 eqs. **DLC.** Transl. of **Udarnye volny v obolochkakh zvezd,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(3):410–421, May/June **1959. DLC**—The physical properties of shock waves in stellar envelopes are studied, taking into account, first of all, interactions with radiation. For simplicity, steady-state shock waves are assumed. *Subject Headings:* **1. Shock waves 2. Stellar spectra.**—*Authors' abstract.* Ⓢ

11L–393 534:523.877

Weymann, Ray (*Princeton Univ. Obs.*), **Heating of stellar chromospheres by shock waves.** *Astrophysical Journal*, Chicago, 132(2):452–460, Sept. **1960.** fig., 9 refs., 30 eqs. **DWB, DLC**—On the basis of a very simple model for the dissipation of energy by shock waves, the structure of the chromospheres of stars with very different values of the surface gravity is discussed. Sharp jumps in the temperature at certain critical points would be expected. Reasonable chromospheric structures follow from this model for dwarfs, but nor for stars of very low surface gravity unless very long-period shock waves are considered. The question of the thermal stability of the solutions is discussed. *Subject Headings:* **1. Shock waves 2. Stellar chromospheres.**—*Author's abstract.* Ⓢ

11L–394 523.877

†Zhevakin, S. A., **On the calculation of nonadiabatic stellar pulsations by use of a discrete model.** *Soviet Astronomy AJ*, New York, 3(2):267–279, March/April **1959.** fig., 40 refs., 18 eqs. **DLC.** Transl. of **O raschete neadiabatnykh kolebaniĭ zvezd pri pomoshchi diskretnoĭ modeli,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(2):269–282, March/April **1959. DLC**—The methods of calculating radial nonadiabatic stellar pulsations proposed by Woltjer and Rossieland are considered in brief. It is pointed out that these methods require much more laborious calculations than the discrete-model method. A method for calculating radial nonadiabatic pulsations by use of a discrete model of a stellar envelope is elaborated. The necessity of taking into account the sphericity of the stellar envelope is shown. The conditions of applicability of treatment by a discrete model are formulated. A discrete multilayer spherical model of a pulsating stellar envelope is constructed. The equations of motion of this model are deduced and linearized, assuming radioactivity energy transfer. *Subject Heading:* **1. Stellar pulsations.**—*Author's abstract.* Ⓢ

11L–395 523.877

Pikel'ner, S. B. and Gershberg, R. E. (*Acad. Sci., U.S.S.R.*), **On the possibility of the formation of filamentary structures by twisting.** *Soviet Astronomy AJ*, New York, 3(5):765–772, March/April

1960. 2 figs., 2 tables, 11 refs., 26 eqs. **DLC.** Transl. of **O vozmozhnosti obrazovaniia voloknistykh struktur skruchivaniem,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(5):785–793, Sept./Oct. **1959. DLC**—The possibility is considered of the formation of filaments common in nebulae and other cosmic objects, by a mechanical pinch-effect. If the ends of a tube of magnetic-force lines are connected with two dense vortices rotating in opposite direction, then it can be assumed that in some part of it there is a linear dependence between the angular velocity and z. The problem is solved at first without accounting for the Jovie losses. The field H_α, arising as a result of twisting, compresses the gas towards the axis. The density distribution at some instants of time and four different conditions is illustrated. The role of damping is estimated for the stationary case. It is negligible for H II regions of interstellar gas, but prevents the formation of filaments in H I regions and in the chromosphere. The energy of the vortices necessary for compression applies to be acceptable. The stability of the filaments formed is briefly discussed. *Subject Heading:* **1. Stellar filaments.**—*Authors' abstract.* Ⓢ

11L–396 523.877:523.841.3

Zhevakin, S. A., **Ob izmenenii fazy i amplitudy kolebaniĭ potoka izlucheniia pri prokhozhdenii cherez neadiabatnuiu obolochku pul'siruiushcheĭ zvezdy.** [The phase and amplitude variations of oscillations of the radiation flux passing through a non-adiabatic envelope of a pulsating star.] *Astronomicheskiĭ Zhurnal*, Moscow, 37(3):443–457, May/June **1960.** 7 figs., 5 tables, 13 refs. Russian and English summaries p. 443–444. Transl. into English in *Soviet Astronomy AJ*, New York, 4(3):422–433, Nov./Dec. **1960. DLC**—A five-layer discrete model of a stellar envelope is constructed so that: 1) its quasi-adiabatic oscillations are similar to the quasi-adiabatic oscillations of the initial model of the envelope with distributed characteristics, 2) the discrete model describes in detail and completely as possible the non-adiabatic oscillations of that part of the envelope, in which the phase and amplitude variations of oscillations of the radiation flux are especially large, i.e. that the number of layers into which this part is stratified be relatively large. The computation of non-adiabatic oscillations by means of the so constructed five-layer discrete model gives a possibility of following (at different values of the parameter of non-adiabatic oscillations of the He II double ionized critical zone) the phase and amplitude variations of the radiation flux passing through the non-adiabatic envelope of the pulsating star. As a result of peculiarities of formation of the phase-shift of variable stars, noted previously by the author, are confirmed, namely: a) in the case of Cepheids (a positive phase-lag of maximum brightness relative to maximum contraction of the star, $\psi \approx +90°$) the phase and amplitude of oscillations of the radiation flux emerging from the star is formed in the He II doubly ionized critical zone, b) in the case of long-period variables of the Mira Ceti type (a negative phase-lag of maximum brightness relative to maximum compression of the star, $\psi \approx -90°$) the phase and amplitude of oscillations of the radiation flux are formed in layers lying above the He II doubly ionized critical zone. In the case of RR Her type variables, $\psi = 0°$, the phase and amplitude variations of oscillations of the radiation flux can be followed along the radius of the star. The linear density distribution of oscillations of dissipation energy dW/dr_0, where r is the distance from the center of the star, is determined. From a comparison of computational results of several variants of discrete models conclusions are made on the influence of the method of stratification of the envelope and also the influence of helium abundance in the envelope and other parameters on the phase and amplitude of the radiation flux emerging from the star. An estimate is made of the precision of computation of non-adiabatic oscillations of the envelope by means of four and five-layer discrete models. *Subject Headings:* **1. Stellar pulsations 2. Stellar variability.**—*Author's abstract.* Ⓢ

11L–397 523.877

Masevich, A. G. (*P. K. Shternberg State Astron. Inst.*), **On the later stages of stellar evolution.** *Soviet Astronomy AJ*, New York, 3(5):773–777, March/April **1960.** 5 figs., table, 12 refs. Transl. of **K voprosu o pozdnikh stadiiakh razvitiia zvezd,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(5):794–799, Sept./Oct. **1959. DLC**—Stellar models with partially degenerated isothermal cores ($\psi_0 = 0; 2; 5$) constructed by K. Kaminisi are discussed. Similar models for $M = 0.5; 0.6; 0.7$ O have been constructed. The comparison with observation shows that with the help of these models the structure of white dwarfs as well as the place they occupy on the H-R diagram can be satisfactorily explained. The most important feature of such a model is the smaller degree of degeneracy for white dwarfs compared with other models. The difficulties connected with a high probability of nuclear reactions at high pressures pointed out by J. B. Zeldovitch do not seem to occur in this case. The validity of the theoretical mass-radius relation (derived for completely degenerated configurations) for real white dwarfs is considered on the basis of existing observational data. M. Schwarzschild's views on white dwarfs being the latest stage of evolution of red giant stars are shown to meet with serious difficulties for stars with mass >1 ⊙. *Subject Heading:* **1. Stellar evolution.**—*Author's abstract.* Ⓢ

11L–398 523.877 :523.037

Bailey, V. A. (*School of Physics, Univ. of Sydney*), **Existence of net electric charges on stars.** *Nature*, London, 185(4724) :508–510, May 14, **1960.** 13 refs., 2 eqs. Note: A more complete account of this work is in the course of publication in the **Journal** and **Proceedings** of the Royal Society of New South Wales. **DWB**—The hypothesis that a star like the sun of mass $M_s gm$ carries a net negative charge, $-Q_s$ which is given by the formula $Q_s = \beta_s G^{\frac{1}{2}} M_s$ e.s.u. where β_s is a pure number of the order of 0.03, makes it possible to account for the order of magnitude of at least five different astronomical phenomena and the directions relating to three of them. Possible sources of the change are considered. Possible criticism of the hypothesis is discussed. *Subject Heading:* **1. Electrical charges on stars.**—*E.Z.S.* Ⓢ

11L–399 523.877

Sobolev, V. V. (*Leningrad State Univ.*), **On the theory of radiation diffusion in stellar atmospheres.** *Soviet Astronomy AJ*, New York, 3(4) :563–568, Jan./Feb. **1960.** 10 refs., 36 eqs. **DLC.** Transl. of **K teorii diffuzii izlucheniia v atmosferakh zvezd,** *Astronomicheskiĭ Zhurnal*, Moscow, 36(4) :573–578, July/Aug. **1959. DLC**—The integral equation with a kernel depending on the absolute value of the difference of two quantities is investigated in this paper. The solution of this equation (both homogeneous and nonhomogeneous) is found according to the method proposed previously by the author. As an example, the integral equations of radiation diffusion are considered. *Subject Headings:* **1. Stellar radiation diffusion 2. Stellar atmospheres.**—*Author's abstract.* Ⓢ

CONSTELLATIONS

See also: **New emission stars in the constellation Orion** (Manova), 11L–350.

11L–400 523.88

Courtès, Georges and Cruvellier, Paul (*both, Observatoire de Marseille*), **Mesures interférentielles de la vitesse radiale des régions HII situées dans la direction du grand et du petit nuage du Sagittaire.** [Interferential measurements of the radial velocity of the HII regions in the direction of the large and the small clouds of Sagittarius.] *Annales d'Astrophysique*, Paris, 23(3) :419–421, May/June **1960.** fig., table, 3 refs. French, English and Russian summaries p. 419. **DWB, DLC**—The regions located in the direction of the great and the small clouds of Sagittarius have been studied and radial velocities of H_α radiation have been measured. Results are as follows:

$v = +\ 6.7$ km/s for OHP 21 E 37, direction of the small cloud,
$v = +13$ km/s for OHP 6 E 13, direction of the great cloud.

Subject Headings: **1. Sagittarius clouds 2. Radial velocities.**—*Authors' abstract.* Ⓢ

AUTHOR AND SUBJECT INDEXES

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